

# QL USER

**GRAPHICS  
ON DISPLAY**

**MONOCHROME  
MONITORS**

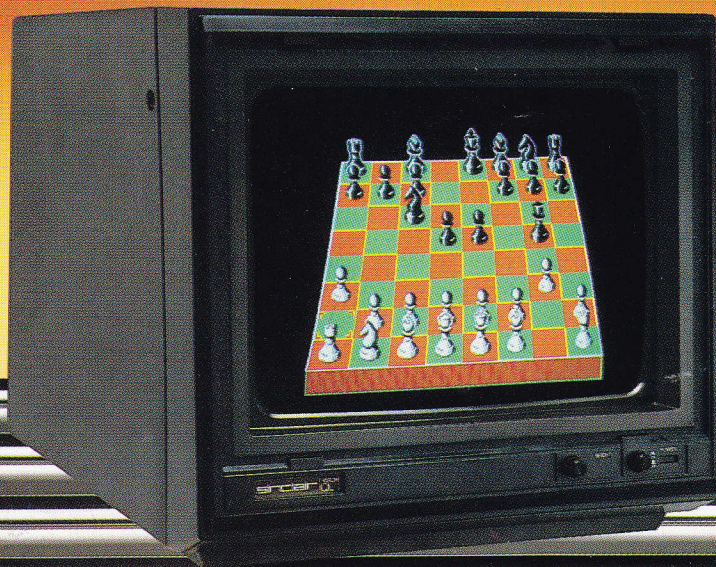
**SOFTWARE  
ROUNDUP**

**WIN** A SILICON EXPRESS  
DISK SYSTEM - p31



## **THE QL DISK QUARTET & EXPANSION ENSEMBLE DRIVING IN FOUR DIMENSIONS**

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# QL USER

June 1985

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## It's Magic

It's been quite a bumper month for competitions, as we can announce the winner of the Computamate disk system (April issue) and five (see 'The Progs') of the Talent Spot (March issue) winners – the other five will appear next month.

The winning word in the Computamagic Competition was PHARMACOGNETICISTS (19 letters), sent in by B Rees, Gillingham, Kent. He receives the Q-disc interface and dual drives from Computamate.



Who are these jolly fellows parading assorted hardware and imbibing champagne? They're the winners of our recent 'Quest For The Engram' competition, along with Quest VIP and our illustrious Editor (on the far right and left of the picture respectively).

Presenting the prizes, Grant McKewen (he of the shaven chin) was able to spring an extra surprise and give each winner a substantial upgrade on what was originally offered when the competition ran. The three third prize winners (Mr J Stevens of Romsey, third from the left, back row; Mr D Nixon of Southampton, second from the left, back row; and B T Szocik, who was unable to attend), received a 128K RAM card each; in second place Mr V Holland (also unable to attend – a colleague seated on the left of the picture accepted the prize in his place) was given a 256K RAM card and 'Cash Trader', and for the outright winner – Mr Christopher Abbess, from Woodford Green in Essex and a lecturer at Middlesex Polytechnic; seated on the right – Quest parted with one of their treasured 400K dual disk drives.

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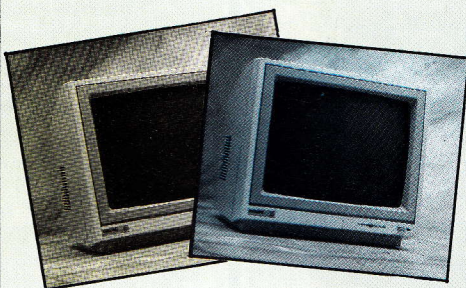
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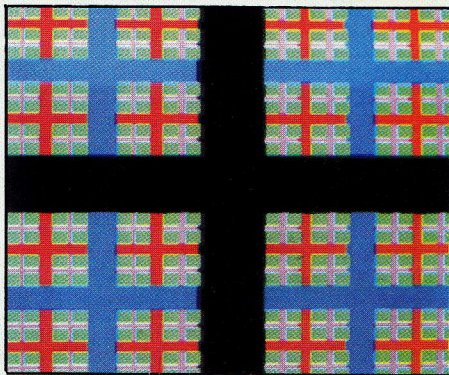
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Adding the embellishments made possible using BCPL to last month's crude but operational emulator.

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A new series designed to take the novice graphics inquisitor through to sophisticated screen handling.

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## Instant Access

Vital data on QL hardware, software and books.

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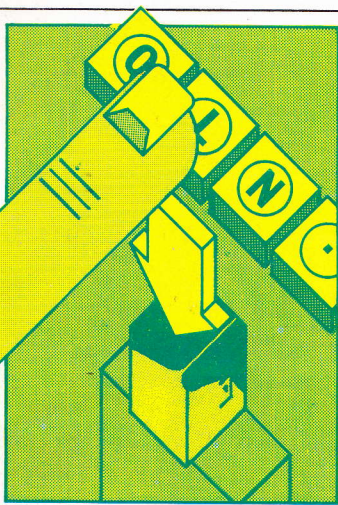
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## News-in-brief and latest developments on the QL market from our roving reporter, Sid Smith.



### Mistaken Mole

We said last month that the JS ROM was not on general release and found its way into returned QLs by mistake. At that time, we were assured it was still "under development".

As owners of issue 14 machines will have discovered, however (by entering PRINT VER\$), the JS ROM seems to be present in all new QLs.

Anyway, we are at least sure about the content of the new ROM – and included a description in the QL User Newsletter, which will be sent to anyone who has completed our recent registration.

We'll carry a full description of JS contents in a future issue. Meanwhile, our mole at Sinclair has been suitably rebuked.

### Bow To Business

Microvitec, Bradford's monitor manufacturer, has unveiled (or plugged in) an all-tilting, all-swiveling version of its QL-compatible display.

Certain to satisfy all sizes of QL owner, the tilting monitor contains the same 85 column,

653 pixels-per-line, 18MHz tube as the company's earlier QL display – though the new box only raises the price to a mere £20 extra.

Microvitec say that the device "reflects the demand from a growing number of business users for a 'workstation' display".

Ignore the sickly-looking specimen in our picture; the new monitor is finished in genuine QL black and adds that 'finishing touch'.

### ROM Rumours

The appearance of a second version of the QL, incorporating the Psion packages in an on-board ROM chip, now seems less likely.

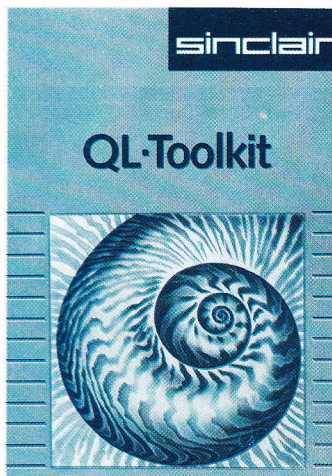
Sinclair MD Nigel Searle told your reporter that, "We will be bringing out Exchange for the QL on a plug-in ROM – it'll plug into the expansion bus, because of the addressing that it takes up. But there's a question mark over whether we'll incorporate it into the basic hardware; I think that depends somewhat on the reaction to, and the demand for, the plug-in version."

Exchange is Psion's name for an integrated version of its four packages supplied for a variety of disk-based machines and on ROM cartridge for the ICL One Per Desk.

Searle was unable to give a price for the Exchange ROM, and could only date its release as "around the middle of the year".

### Toolkit Mk II

Sinclair is already working on a new version of the recently released QL Toolkit of extra SuperBasic commands. The new issue will be more than twice as long – but, says the author, will cost around the same.



The original Toolkit

Tony Tebby, who originally wrote QDOS, told us that the first Toolkit had been limited to 60 or so new commands by a desire to keep down the overall size of the package.

However, "We're going to include a configuration program and a linker. This means we can expand the Toolkit from below 8K to around 20K, and people can just select the commands they want. We've already got most of the extra material, so there'll probably be no price increase."

Extra commands might include more extensive copying facilities, screen dump to various printers, mouse interface software, and (against Tebby's better judgement) a key re-define function.

Tebby expects the version 2 Toolkit to emerge at the end of the summer, with – perhaps – an intermediate version before then.

### Modem Moves

At least three companies have expressed an interest in rescuing QL modem-maker OE Ltd from receivership – and many modem-orderers from a £150 loss.

At the time of writing, none have signed a definitive

agreement, and their ardour has been cooled somewhat by a series of executive departures from the Cumbria-based concern.

So far, OE's range of technical skills and comms products have attracted the attentions of Norbain, modem makers Tandata and – most remarkably – Computrade, the Israeli distributors for Sinclair products.

However, at least one of these suitor companies has said that the loss of OE executives like MD Martin Ansell, Sales Manager Bob Johnson and London Sales Director Rob Lineham has seriously reduced the attractiveness of the troubled comms manufacturer.

Meanwhile, another QL modem has been developed by Swansea-based Commpak Data. The device, to be known as "The Bright Star", is a hard-wired modem built around the classy 7910 chip. It will be available from Modem House.

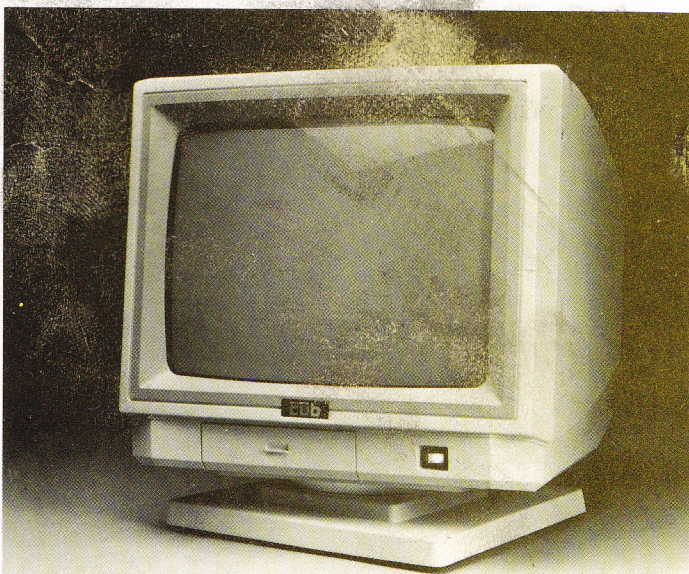
Keith Webb, its designer, reckons the device to be superior to the Sinclair-commissioned OE package in several respects – it includes the provision of 300/300 and 75/1200 baud rates as standard, and an integral Centronics printer interface whose 2K buffer allows real-time print-outs of incoming data.

"We planned to charge £160 for it so that we'd undercut QCOM as well as outperform it," he says. "But the price depends on distributors taking a smaller cut than they're used to, so it might have to go up."

Keith is aware of the strong feeling at Sinclair that QCOM must be saved, but expects to benefit from widespread resentment felt against OE.

### Stop Press

Modem manufacturers Tandata have bought all rights and stock for OE's QCOM. The sum involved is rumoured to be in six figures. OE's debts would not appear to have been assumed, however, Tandata are understood to be offering discounts for those re-ordering QCOM through them. Finally, it is understood that the cost of the control unit will be increasing by some £15-£20.



The new Microvitec Cub (albino version?)

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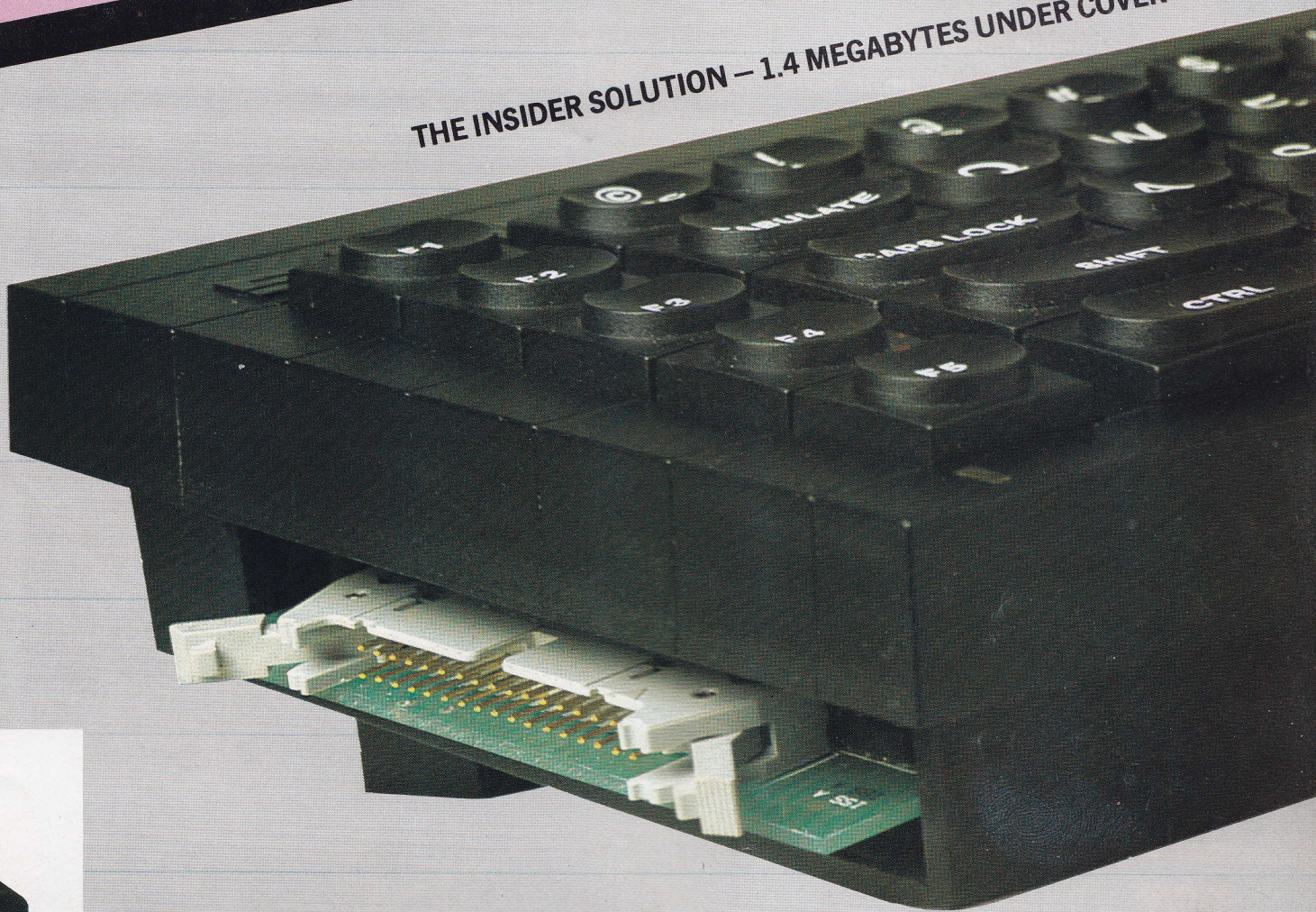


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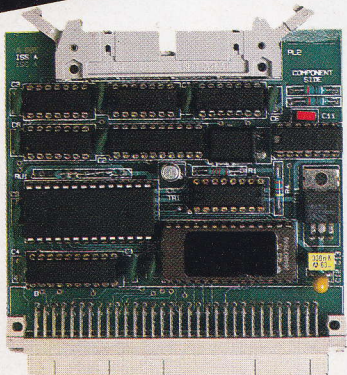


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**DRIVING IN DIMENSIONS**

Paolo Baccanello and David Green BSc join forces to bring you a special preview of the new four-way expansion console from Computamate, plus side-by-side comparison of Quest, CST, Silicon Express and Micro-Peripherals disk systems.

**FOUR**

**DRIVING IN DIMENSIONS**



# D

espite the passing of a full and fun-packed year, the QL has still to realise its true potential within an as-yet undefined market. One obvious hindrance to this realisation has been the slow development of QL-dedicated hardware and the even slower appearance of companies prepared to stake their claim in the QL market.

All that now looks to be changing, however, with the release of several, different, professionally-produced disk systems and at least one of the long-awaited and much hailed expansion boxes, allowing the use of more than one peripheral at a time. What's more, Sinclair have finally climbed down from their pedestal to fix some disk

development of CST's system.

The additional commands provide group file operations, paged directories, file specification, number base conversion and default drive settings amongst other things.

Close on the heels of Computamate were MicroPeripherals, with an interface of similar appearance and dimensions. Where MP's differs is in their choice of 3¼" drives, making the complete system exceedingly compact.

MicroPeripherals have also opted for a set of 'Toolkit-like' commands – the result of collaboration with Sinclair rather than any contact with Mr Tebby. These special utilities include a microdrive emulator which allows any software that normally runs on

downfall if the promised proliferation of 68K software is not forthcoming.

The Quest anathemas don't stop there, however, as their system currently requires booting up from microdrive rather than EPROM and though it only takes 20 seconds or so it's still annoying.

Finally, we have Silicon Express, newcomers to the QL market and better known as custom chip designers, they produce the Insider interface board and sell it along with their own drives.

Silicon Express's disk interface is the smallest of those we have reviewed. It consists of a bare PCB measuring 100 × 100 that plugs into the QL's main I/O port on the left hand side of the

format standards, which others defy at their peril...

Arriving on the scene first were Computamate, with the Q-Disc interface manufactured by CST. This is available with optional Teac drives (double or single sided), but will also function with any Shugart compatible units as should any of the other systems. The interface comes as a small PCB (105 × 145mm) with an edge connector at one end and a matt black housing at the other. This slots into the end port on the QL.

An integral part of the Q-Disc system is the host of extra commands, which bear a striking resemblance to those found in the QL Toolkit. This has a lot to do with the fact that Toolkit's author (Tony Tebby) also had a hand in the

microdrive to run on disk. Other enhancements include extra error messages and later ROMs will include lots more.

Next up were Quest, who seem to have taken a leaf out of the 'Sinclair Book of Marketing Strategy', by preceding their launch with publicity about six months before the drives arrived. Now they're here, however, some critics are asking what took so long – both the interface and drives are around a third as big again as nearest rival units Compumate; though the drive housing does include a cooling fan.

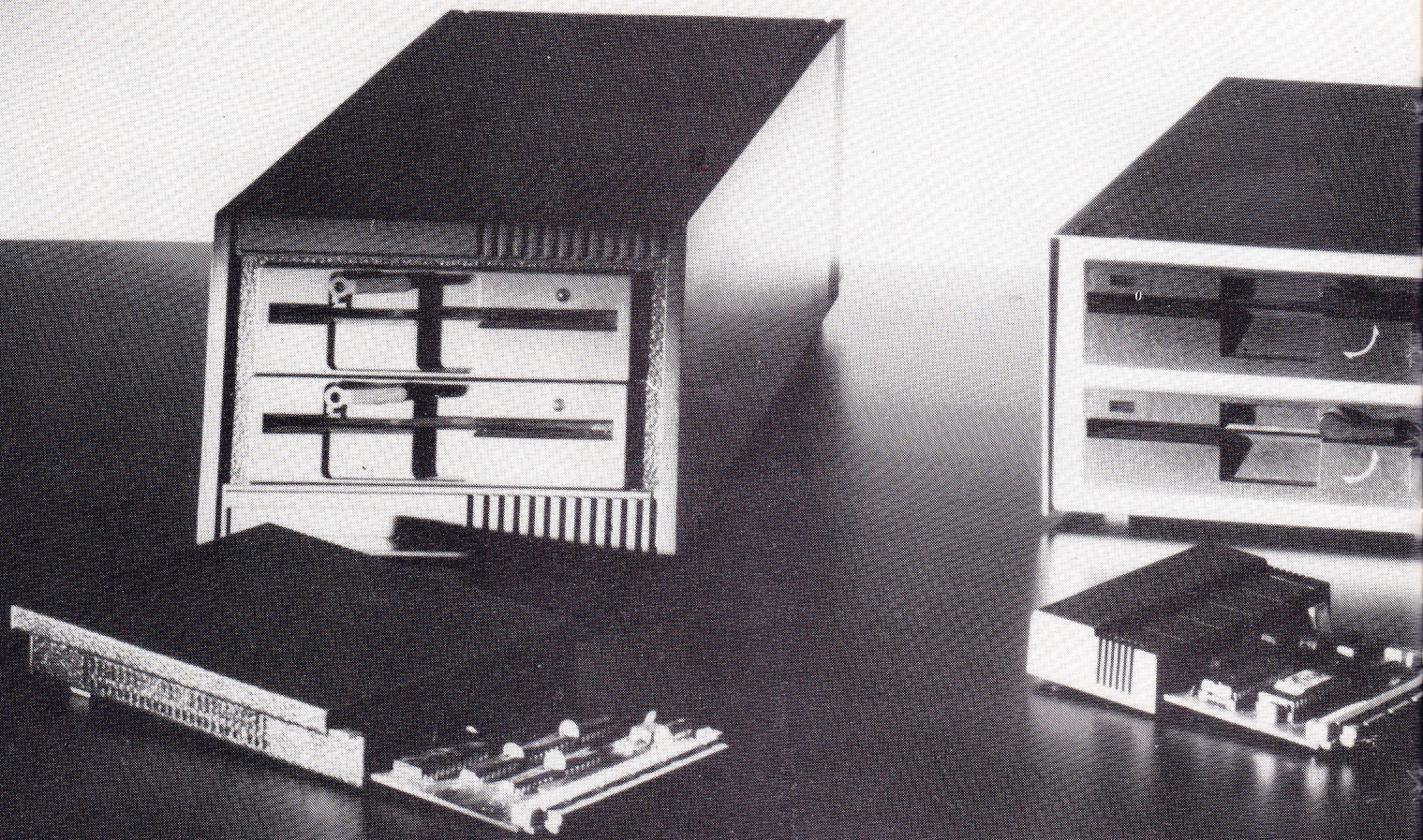
Another reason for all this extra bulk is due to Quest's decision to make all their equipment compatible with CP/M 68K – a bold move and one which could prove their

computer. When inserted, though exposed to the elements, the PCB lies out of sight beneath the QL's leading edge.

The drives available with the Insider board measure 155 × 95 × 300mm and rate amongst the most compact and stylish around. The actual mechanisms are made by Toshiba, but the rest of the electronics are pure Silicon Express.

In operation both interface and drives function smoothly. Disks formatted on other drives can be written to and read from with no difficulties, indicating that users should have no problem in using commercial disk-based software if and when it arrives.

On the software side Silicon Express provide only one



additional command to SuperBasic: FLP\_USE enables the user to assign any device name as the disk driver. Swapping the names mdv1\_ and mdv2\_ for flp1\_ and flp2\_ respectively enables software written exclusively for microdrive to run on disk. The

Insider is also supplied with a comprehensive manual that explains all aspects of disk operation and culminates with an addendum on the ubiquitous Toolkit.

Returning to CST, they're fast earning themselves a reputation as the front runners

in the QL peripheral field. First out with the disk interface, they have now produced the first independently-powered expansion board for the QL.

Aptly named the Plus 4 their device incorporates four 64-way I/O ports identical to the single port on the QL. Also

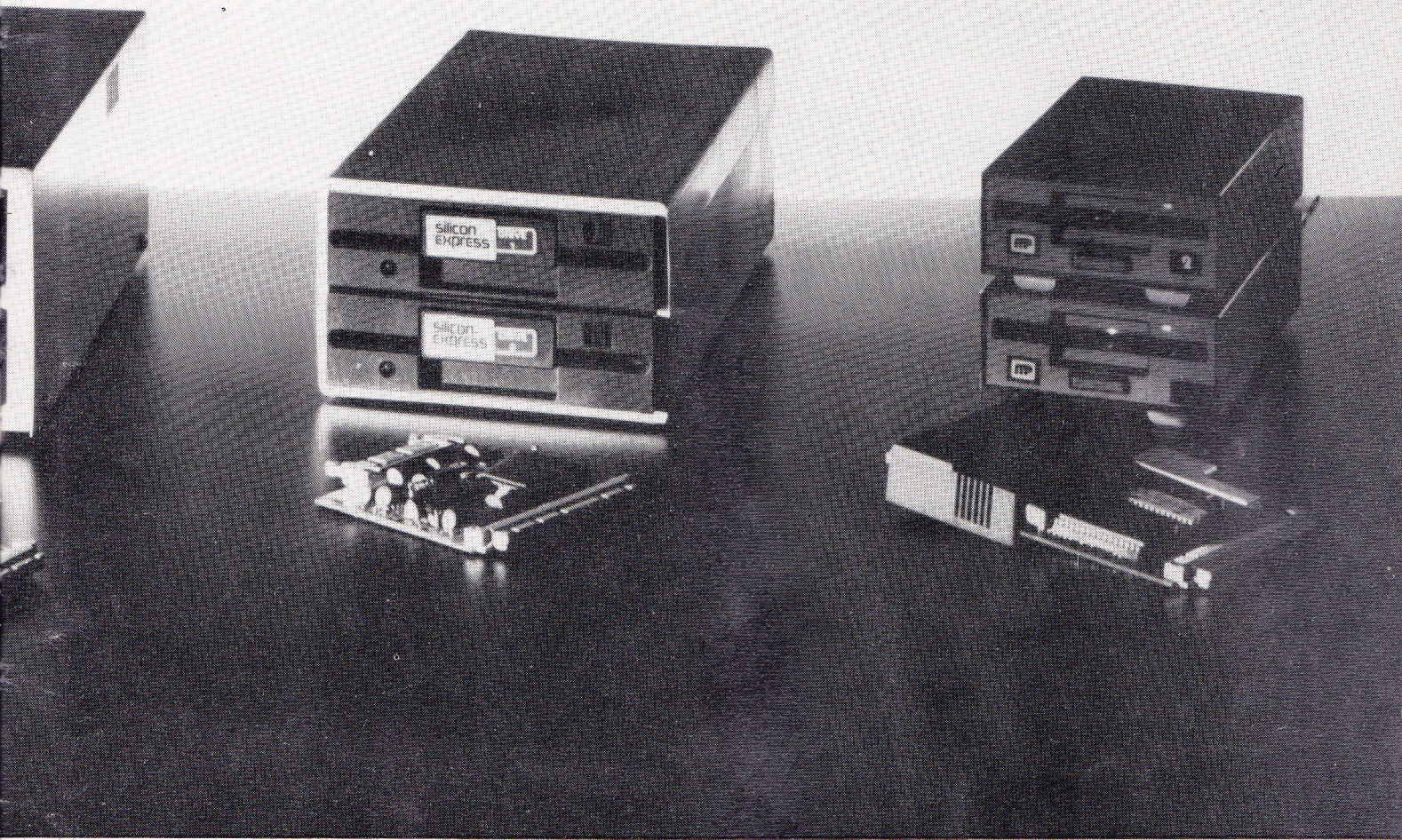
thrown in is a 16 bit uncommitted parallel I/O port. These are housed in a sturdy black metal casing measuring 480 x 200 x 35mm (length x width x height) on top of which the QL is destined to sit. To stop it from sliding off there are indentations in the metal for its rubber feet. Also the area upon which it rests is angled for easy access to the QL's keyboard.

A small ribbed black plastic interface connects the QL up to the expansion board. It consists of a PCB with an on-board ROM. At its end is a short length of 32 way ribbon cable which plugs into a socket in the expansion unit directly below. Interestingly the Plus 4's external power supply plugs into this interface and not the expansion unit itself.

The four main I/O ports on the Plus 4 are located at its rear. Ideally each of these will support any device that on its own links up to the QL. This was found to be true for equipment from Simplex, Quest and GST. However, it must be stressed that in each case the latest version of the

BENCHMARK	udv	C'mate	MP	Quest	Si Exp
CREATE	37.00	5.00	16.00	14.00	6.00
APPEND	14.16	11.52	11.84	12.14	11.78
DISPLAY	4.24	4.38	4.20	4.32	4.18
ORDER	1.24	0.20	0.40	0.24	0.24
LOCATE	0.22	0.10	0.08	0.14	0.10
FIND	0.66	0.28	0.50	0.42	0.27
SEARCH	0.35	0.19	0.29	0.19	0.16
udv emul?	-	NO	YES	NO	YES
File cmds	-	38	7	0	0
Extras	-	NONE	NONE	CP/M 68K	NONE
Software	-	ROM	ROM+Disk	Disk	ROM

The table above shows timings in seconds per single Archive operation. A proportion of each operation must be attributed to software run time. Finally, note that the routine 'append' was used to generate a record and its contents, as well as to write it out to disk or microdrive.



relevant hardware was used.

To ensure that the expansion board will work with early QL's a routine in the Plus 4's ROM checks the QDOS version number. If this is found to be JM or earlier it goes on to correct the infamous bug that prevented the operating system from recognising more than one additional device.

Located on the right hand side of the unit is a 16 bit uncommitted parallel I/O port. This will ultimately provide a link to such exotic devices as analogue to digital converters or tape streamers as well as open up an avenue for high speed communication with other computers. As such developments may be a long time coming, added circuitry permits the port to double up for more conventional use. Namely, as an 8 bit parallel printer port.

The power supply for the Plus 4 is optional. Two of the units four I/O slots may be used running off the QL. However, as this would bring consumption perilously close to the QL's 3400 milliwatt ceiling it would seem inadvisable.

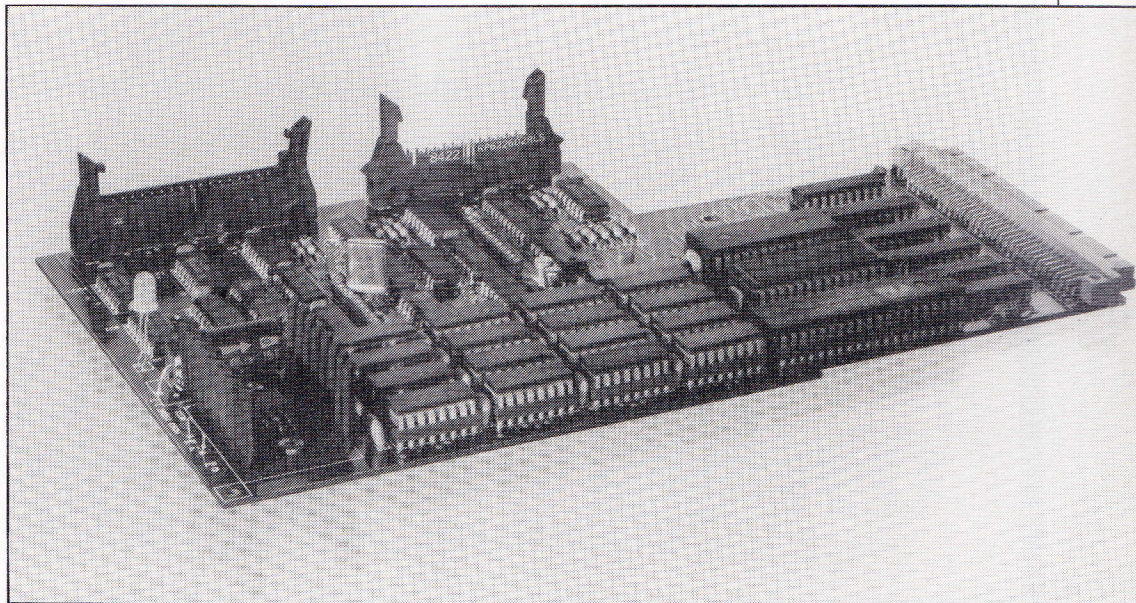
When connected the external supply is capable of powering not only the board but also the QL and any disk drives connected.

Overall then CST's Plus 4 comes as something of a breakthrough. Where previously the QL could support no more than one

device, the field is now open. This transforms the QL from simply an entry level small business machine to a system capable of expanding alongside the needs of the business. Users will be able to mix and match products as they go and will not be tied down to a single manufacturer.

### Addendum

Shortly after preparing this article, we were visited by Medic Datasystems who now have a fully fledged system in production (as evidenced by the photograph below), which we will be reviewing in full next month.



# AT LAST! THE QL COMMUNICATES ANNOUNCING THE QL BRIGHT STAR

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Main specifications: CCITT V21/V23, BELL 103/113

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# OPEN CHANNEL

If you have any comments or anecdotes about QL User or the Sinclair QL, send them to: 'Open Channel', QL User, Priory Court, 30-32 Farringdon Lane, London EC1R 3AU.



## Dirth Of Drives

In October last year we decided, as a small business, to purchase a QL for running a number of programs mainly involving the Abacus Spreadsheet. We have successfully prepared overlays which give us component costing, product cost control and part of our accounting requirements.

I am sure we all appreciate the value of having back-up copies of these data files. However, it has not been possible for us to produce back-up copies since we have not been unable to provide microdrive cartridges to carry out this task. Not only have we not been able to provide insurance for our files in the form of back-up copies, but we have now reached the limit of the storage capacity in the existing microdrives (we have sixteen of these).

For the past six or seven weeks we have been trying to obtain QL microdrives in a thirty mile area without success. W H Smith, Swindon, which is a Central Distribution Depot, must be absolutely fed up with our complaints about the lack of supply and goodness knows how many more people are complaining about this inadequacy.

G M Foster (Director)  
HoMach Systems Ltd

## Quill Editor

MD Newport wrote a screen editor in Super Basic because of the "absence of a full screen editor". What is wrong with Quill?

First, install one of the 'OTHER' printer drivers with the End of Line code set to <LF>. Then load Quill, and using the design option, set the page size to zero. To edit an existing SuperBasic program, select IMPORT from the

FILES command. The SuperBasic filename must have an extension, otherwise IMPORT appends its default. The full Quill controls can now be used to edit the file.

When the file has been edited, a SuperBasic file must be re-written. This can be done by using the 'PRINT, current, whole, to file-name command'. Then abandon the document, restart SuperBasic and load the file.

Finally, I have discovered yet another of the QL's many bugs. The DLINE instruction in line 100 isn't having the desired effect. Try running the program below twice. The second run shouldn't do a DIR of MDV1\_ - but it does! Can DLINEs be trusted?

```
10 MODE 4
20 WINDOW#0, 512, 42, 0,
  214
30 WINDOW#1, 309, 198,
  203, 0
40 WINDOW#2, 203, 212, 0,
  0
50 BORDER#0, 1, 2:
  BORDER#1, 1, 4:
  BORDER#2, 1, 4
60 SCALE 100, 0, 0
70 PAPER#0, 0: PAPER#1,
  0: PAPER#2, 0
80 INK#0, 4: INK#1, 4:
  INK#2, 4
90 DIR MDV1_
100 DLINE 90 TO 100
```

The program isn't significant but it does create a nice screen which leaves room for a clock to be EXECed on the screen as well.

Paul Cooper  
Stansted

## No-Hoper

Let me start by giving a bit of background: I am employed as an assistant programmer by one of the large British banks so I have a fair amount of programming experience and ability but I have one major fault, namely I have a poor imagination. As a result I often find myself at a loose end sitting in front of my QL, when I would dearly love to do some programming but am completely devoid of ideas.

My theory is that it takes a very logical mind to write programs and a very creative mind to dream up ideas, and very few people are blessed with both. I would therefore be

very grateful of suggestions from some creatively minded people for quick and easy programs to write at home which will stop me getting bored and, with any luck, be of some use or entertainment when they are finished.

M Begg  
Sheffield

*The overwhelming and varied response that we have received for our PROGS section leads us to question the theory that few people are blessed with both a logical and, at the same time, creative mind. Nevertheless, we hate to see one of our readers at a loss. So would those whose heads are brimming over with wild and imaginative schemes oblige someone upon whom the QL has failed to work its magic!*

## Sight and Software

Having used my QL on a black and white TV with unsatisfactory results, I am looking for an alternative capable of high resolution graphics and 85 column displays. Also which is better, the Sinclair Vision QL or the Microvitec Cub 1451/DQ3? On a different tack, I would like to know which assembler and what version of FORTH is best suited to the beginner?

Colin Mansfield  
Waterford

*If you can live without colour then a monochrome monitor would seem the obvious choice. Resolutions are usually higher and prices considerably lower than hybrid TV/monitors. However, if you need colour but cannot justify the cost of a device which can only be used alongside your computer you could take a look at the Ferguson MC-01 TV/monitor.*

*As for the Vision QL and the Microvitec, the former is more compact with a smaller screen (12" as opposed to 14"). This reduces the size of text and increases the brilliance of the display. The latter, on the other hand, now comes with an attractive, hi-tech swivel stand. Beyond this,*

*with identical resolutions, there is little to distinguish the two.*

*Moving onto the software query, Computer One's FORTH package is the only one currently available so look no further. With assemblers, however, you have a far wider choice. For speed and ease of use we would recommend Computer One's program, though for power and sophistication Metacomco's product comes up trumps. Finally, if you are a beginner you will find a monitor-disassembler indispensable.*

## JS Chip Chat

With regard to my item on the new QL 'JS' ROM, reference was made to a new trace facility. Shortly after I made this guess as to what the new 'TRA' command does, I discovered the truth.

The 'TRA' command actually allows the re-vectoring of error messages and prompts (as hinted in the rest of the article) and also the changing of the characters printed upon receipt of character codes and is short for 'TRANSLATE'. I am afraid I have to tell you that no trace command is provided in the new 'JS' ROM!

I hope this clears the matter up for the readers of 'QL User' and for the benefit of Ms Sara Johns, Customer Relations Manager at Sinclair Research, who contacted me about the matter recently but insisted: "The features are either for foreign built QL's or are prototype features that are in the process of being developed by our engineers. They are not complete and may change in future versions of the QL".

QL owners still stuck with the version 'AH' ROM will no doubt be eager to find out just how many more releases of the QL Sinclair Research intend to issue!

Alan Turnbull, BSC

## Sinclair Cynicism

It seems that Sinclair have decided to alter the QL ROM yet again without offering this latest version to those who

have supported this machine through its first year. A good proportion of these people have already supported previous Sinclair computers and paid £35 to join the QCLUB for the privilege of getting the latest version of software that is now free with the new machines, together with QCLUB membership.

I feel that companies like Sinclair forget that without the support of Joe Public, who buy these first few thousand machines and put up with all the problems associated with a new product they would not be in a position to re-launch with new software, bugs corrected and a super SuperBasic. The company should show concern for its user base and offer up-grades for machines as they become available. After all if Acorn can do it, so can Sinclair. Anyway here's hoping.  
*P R Hollands  
Romford*

### Keyboard Cache

It amazes me that simple things like keying [CTRL] + [F5] to freeze the screen or cursor key editing should be discovered by accident and not documented in the manual. What other unknown delights lurk behind the keyboard?

*Ian McRobert  
Peterborough*

**Try pressing [CTRL] + [ALT] + [7] all at the same time. But before you do so make sure that you have saved everything you are working on.**

### Cushy Code

You should emphasise to readers that you can write assembler in a very inefficient wasteful style and still get lightening fast routines.

Unlike high level languages assembler can be written in a crude form and still achieve astounding results. The technique is to learn the commands which you will usually need and leave out the fancy stuff. Twice the lines of code and twice the space still results in tremendous improvements over any high level language. Unlike other assemblers the MC68000 is not a mind wrecker and about as easy to write as most high level languages.

The technique is to program in SuperBasic. Then hack

away at procedures as assembler routines. Finally, if you're lucky you will end up with one routine in assembler language.

Anything connected with I/O is better dealt with in SuperBasic as a general rule, if only because you are functioning at operator speed.  
*JD Thomson  
Penarth*

### Off Limits

After putting in your programs on Sprites, I found that Lunar Lander had one bug that I could not get rid of (probably my programming). This occurred at line 350 giving the message "end of file". This aside, may I say how brilliant the Sprite Designer was. I find it indispensable for making characters for my games.  
*Andrew Keen  
Studley*

Having received QL User from the first issue, I decided I would put a program in. I opted for Instant Sprites - Lunar Lander. Having patiently typed in the machine code loader I found it bombed out at line 140.  
*S Bell  
Balderstone*

**Many readers have rung in about this 'End of file' message. This is not a bug. It occurs in one of two situations.**

**Firstly, it crops up when the QL attempts to READ a DATA statement which does not exist. The solution here is to carefully count up all the elements separated by commas in the data statements and compare the total with that for the listing published. Somewhere along the line you will discover that you have left one element out.**

**Secondly, the error occurs if you have run the program more than once and the DATA pointer has failed to be RESTORED or the DATA area has not been CLEARED. Here the QL assumes that once DATA has been READ in it will not have to read in again, and so goes off looking for further (non-existent) statements. The solution is quite simply to type in RESTORE or CLEAR as either command will reset the data pointer to the start of the program.**

# NEXT MONTH SOFTWARE SUPERLATIVES

## The Dynamic Duo

We searched the length and breadth of the country to find the ultimates in business and games software. The result is an in-depth review of Sagesoft's latest business package and a special preview of Sagesoft's latest business package and a special preview of a superb game soon to be released by Sinclair.

## Satellite Stations II

Way back in February we gave you a taste of the QL's potential for communications. Next month, in the follow-up to that feature, we present practical details for interfacing the QL to Psion's Organiser and the Brother range of electronic typewriters as well as reviewing the Brother TC600, complete with portable disk drive.

## Modem Metamorphism

Update on the QL modem stakes, plus a review of the first device onto the market from Modem House.

## Readers' Survey & Prize Draw

Your chance to influence QL User and the QL scene and perhaps win a prize into the bargain!

# JULY '85 EDITION ON SALE 21st JUNE

# GAMES PROGRAMMING

Ian Williams and Steven Hollywood add the finishing touches to the first arcade action game for the QL.

If you've been faithfully entering the program as printed in the last two parts you should by now have a screen full of space invader creatures slithering from side to side and a gun at the bottom of the screen, controlled by the cursor keys (or joystick), with which you can destroy them. This month we'll be adding three large barriers behind which you can skulk, creeping out to hurl bolts of death and destruction, and an explosion routine which utilises a sequential sprite set.

The barriers, three house-shaped objects, are made from a number of sprites, the definitions for which are given at the end of this month's listing. Fig 1 shows how each barrier is made up from the different sprites.

Fig 1

37	38	38	39
38	38	38	38
38	40	40	38

It can be seen that several of the sprites are one single colour, acting as a kind of 'fill' in the shape. It therefore makes sense to use the same sprite definitions for all those sections and consequently 'bar\_tab', a table giving the order of appearance of the different sprites, is used. The sprites are plotted onto the screen row by row, with 'rowloop' (in 'Barriers') taking care of the rows and 'colloop' the columns. Each barrier is plotted separately in red so that the bullet knows it is a barrier it has encountered and not a descending bomb.

The routine 'Bulmov' appeared in the last issue and it's this that detects when a bullet has hit a barrier (to avoid confusion 'bullets' go up, missiles and 'bombs' come down). The lines responsible for detection appear on rems (;) and should be removed by 'entering the program' instructions at the end of this article. The first of these lines checks to see if the collision has occurred below a certain height (199 on the pixel co-ordinate system). If it has, then it ensures that the pixel concerned is red. That being the case, it means the barrier has

been hit and the program branches to 'bul\_hit\_bar'. If the pixel colour is other than red, it means that a bomb has been hit and the branch is to 'endbomb' which will be fully explained in next month's issue.

One problem encountered was how to make the barriers break up in the manner familiar to all arcade fans. A gradual, apparently random type of destruction was needed and two solutions presented themselves. One was for a pseudo\_random number generator using appropriate algorithms. The other was the coward's way out using a sequential counter to read each word in the OS ROM, which proved satisfactory in this instance. 'Rndpos', in the first part, is the name of the variable used to store the pointer and is not initialised. The way it works is quite simple: (a2) holds the position of the variable whose value points to the location in ROM. This value is transferred to a1 which is then used to point to a location from which d5 is loaded. Seven is moved into d1, as 8 lines of dots will be removed (d1 is the counter in the loop). Two is added to (a2) to increase its value and keep it on a word boundary. Line 98 then and's d5 with 7 so that d5 becomes a value between 0 and 7. d5 is then subtracted from d7 (which is the y co-ordinate of the impact) so that, after subtraction, d7 contains the top pixel co-ordinate of the line of dots that require eliminating.

Fig 2

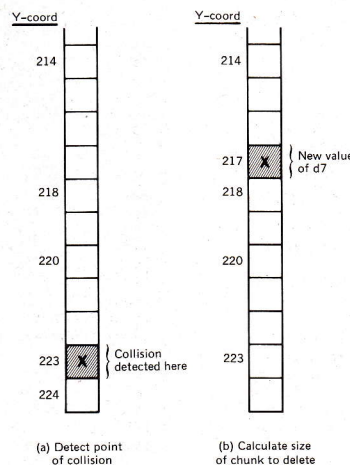


Fig 2 shows a single column of pixels from one of the barriers. The numbers refer to their pixel y coordinates from the top of the screen. If a collision is detected at 223 (said position being stored in d7) and the random number in d5 is, say, six, then d7 will be set to  $223 - 6 = 217$ . At that point d5 is loaded with 224 (the lowest possible point on a barrier) and d7 (now 217) is subtracted from d5 (224) leaving seven in d5. The program then branches to the subroutine 'Vline' which draws a line of black pixels vertically downwards starting at pixel location d6,d7. The line will be d5 black pixels long.

'Vline' utilises a masking technique similar to that used in 'id\_col' described in the last part (May). The major difference is that an inversion of the mask is performed using the 'not' command. This is a device to unplot a dot on the screen and, although it may seem complicated at first sight it soon becomes clear.

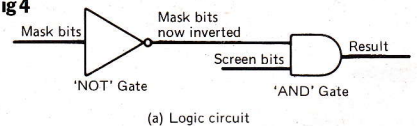
Fig 3

Input	Output	Input			Output		
0	1	0	0	0	0	0	0
0	0	0	1	0	0	1	0
1	0	1	0	0	1	0	0
1	1	1	1	1	1	1	1

NOT                      AND

Fig 3 shows the truth table for the 'not' and 'and' commands. In fig

Fig 4

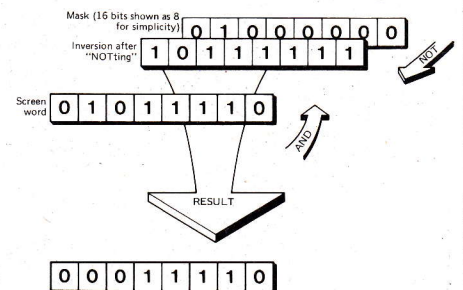


Mask bit	Screen bits	Inversion	Result
0	0	1	0
0	1	1	1
1	0	0	0
1	1	0	0

(b) Table of combined commands

4 a logic circuit and table combining the two commands is given. Fig 5

Fig 5



shows a mask byte (derived from the id\_col data) being 'not'ed with the result that the setting of bits is reversed. If this inverted byte is then 'and'ed with a screen byte you will see a reset (or zero) bit in the mask byte will clear the corresponding bit in the screen byte. On the other hand



a set bit (or one) will have no effect on the screen data. Consequently, if a dot exists on the screen at that point it will be effectively unplotted.

The routines 'loadbarrier' and 'savebarrier' are used to copy the barriers to and from the screen. This means if a player clears a complete screen of invaders, the whole screen will be re-drawn. It will also be necessary to redraw the barriers in their current state, partly demolished or otherwise. Each barrier is saved a screen line at a time, with lines 74 and 55 skipping the parts of the screen line without barrier parts.

'Explode' and 'Draws\_bang' are the last parts of the new routines and, in fact, work pretty hard throughout the whole program. 'Explode' sets up the data from which 'draws\_bang' creates the explosion. The table 'order' is used in much the

same way as 'bar\_tab', that is, it gives the order in which sprites are read from the data to the screen. The explosion is, in fact, a series of sprite frames displayed in rapid succession. Fifteen sprites are used, the first three frames with one sprite and the final three with four sprites. The sprites were created in exactly the same way as the invaders in the first part (April).

This month's program should be added to the end of last month's following the end of the routine 'id\_col'. The sprites must once again be entered exactly as described in the listing. The remainder of the sprites are given this month, including those not required at present. As usual, certain lines from Part 1 (April) and some from Part 2 (May) require their rems (;) removing. These are as follows:

(April)	
line	instruction
12	bsr
	clear
20	bsr setbarriers
21	bsr savebarriers
25	bsr loadbarriers
35	move.b seq_num,d0
36	beq.s no_bang
37	bsr draws_bang
38	no_bang;bsr drop_bomb(note the rem before the bsr which must stay)

(May)	
line	instruction
101	cmp.b #199,d7
102	bls.s notbhb
103	and.w #\$ff00,d2
104	beq bul_hit_bar
126	bsr explode

```

2 ; *****
3 ; *
4 ; * << PALADIN >> *
5 ; *
6 ; * by *
7 ; *
8 ; * STEVEN HOLLYWOOD & IAN G WILLIAMS *
9 ; *
10 ; *****
11 ;
12 ;
13 ; This routine forms the loop which establishes three barriers on the
14 ; screen beneath which you hide from enemy attacks
15 ;
16 ;
17 setbarriers ;
18 moveq #64,d6 ; These lines set up the x and y
19 move.b #200,d7 ; co-ordinates of the first block
20 moveq #2,d3 ; Loop for the number of barriers
21 barloop bsr.s barrier ; See below
22 add.w #176,d6 ; Increases x position by 176
23 dbf d3,barloop
24 rts ;
25 ;
26 ;
27 ;
28 barrier ;
29 lea bar_tab,a0 ; bar_tab = sprite order (see text)
30 move.w d6,d2 ; Saves x position in d2
31 moveq #2,d0 ; Sets up 'rowloop' counter
32 rowloop moveq #3,d1 ; Sets up 'colloop' (see text)
33 colloop move.b (a0)+,d5 ; Reads in first sprite to
34 bsr plot ; be plotted
35 add.w #8,d6 ; Shifts pointer to next x position
36 dbf d1,colloop
37 move.w d2,d6 ; Restore x position from d2
38 add.b #8,d7 ; Increase y position
39 dbf d0,rowloop
40 sub.b #24,d7 ; Reset y position
41 rts ;
42 ;
43 ;
44 ; This places the barrier condition in the buffers (see text)
45 ;
46 ;
47 savebarriers ;
48 lea base_buf, a0 ; base_buf = position of base buffer
49 move.l #26410,a3 ; Memory pos.of base as displayed
50 ;
51 moveq #2,d7 ; See text for a full explanation
52 save1 move.l a3,a1 ; of the process involved
53 save2 move.l (a1)+,(a0)+ ; in placing the bases into
54 move.l (a1),(a0)+ ; the buffer
55 add.w #7c,a1 ;
56 dbf d6,save2 ;
57 add.w #2c,a3 ;
58 dbf d7,save1 ;
59 rts ;
60 ;
61 ;
62 ; This routine moves the previously saved barriers from the buffer and
63 ; places them onto the screen in their current condition.
64 ;
65 ;
66 loadbarriers ;
67 lea base_buf, a0 ; As before
68 move.l #26410,a3 ;
69 ;
70 load1 moveq #2,d7 ; This routine exactly mirrors
71 move.l a3,a1 ; the routine above with the
72 load2 move.l (a0)+,(a1)+ ; difference that the information
73 move.l (a0)+,(a1) ; is moved from the buffer to the
74 add.w #7c,a1 ; screen
75 dbf d6,load2 ;

```

```

76 add.w #2c,a3 ;
77 dbf d7,load1 ;
78 rts ;
79 ;
80 ;
81 ; This routine deals with the collision between a bullet and a barrier
82 ; It requires the x and y positions of the collision in d6 and d7
83 ;
84 ;
85 bul_hit_bar ;
86 move.b d7,d3 ; Saves y pos. of collision in d3
87 lea rndpos,a2 ; See text for random number system!
88 moveq #7,d1 ; This section deals with
89 scrubby move.w (a2),a1 ; the gradual destruction
90 move.b d3,d7 ; of the barriers and is
91 move.w (a1),d5 ; explained fully in the text.
92 addq.w #2,(a2) ;
93 and.w #7,d5 ;
94 sub.b d5,d7 ;
95 move.b #224,d5 ;
96 sub.b d7,d5 ;
97 bsr vline ;
98 addq.w #1,d6 ;
99 dbf d1,scruby ;
100 lea crunch,a3 ; This refers to the explosion sound
101 moveq #17,d0 ; for the barrier defined by 'crunch'
102 trap #1 ; (see last month's issue)
103 rts ;
104 ;
105 ;
106 ; This routine draws a line vertically down of length (d5)
107 ; starting at (d6,d7) .
108 ;
109 ;
110 vline ;
111 movem.l d6-d7,-(a7) ;
112 bsr calc_addr ; Calculates screen address
113 lea mask_tab,a0 ;
114 lsl.b #1,d2 ; multiplies bit number by 2
115 add.l d2,a0 ; Select mask
116 move.w (a0),d2 ; Load mask (see text)
117 not.w d2 ; Inverts mask
118 and.w #255,d5 ; Eradicates undefined byte in d5 word
119 zag and.w d2,(a1) ;
120 add.w #128,a1 ; Move screen pointer down one scr line
121 dbf d5,zag ;
122 movem.l (a7)+,d6-d7 ;
123 rts ;
124 ;
125 ;
126 ; This routine initialises the explosion of everything that goes bang!
127 ; It requires d6 and d7 as x and y co-ordinates of the explosion
128 ;
129 ;
130 explode ;
131 lea order,a0 ; See text...
132 lea seq_reg,a1 ; seq_reg = pointer for order
133 move.l a0,(a1) ; Sets up seq_reg
134 lea wumpx,a0 ; Store the x and y co-ordinates
135 move.w d6,(a0) ; of explosion in 'wumpx' and
136 lea wumpy,a0 ; 'wumpy'
137 move.b d7,(a0) ;
138 lea seq_num,a0 ; seq_num = number of explosion
139 move.b #7,(a0) ; frames still to go
140 rts ;
141 ;
142 ;
143 ; Presents the individual frames of the explosion sequence
144 ; These are drawn at coordinates wumpx, wumpy
145 ;
146 draws_bang ;
147 lea seq_reg,a3 ; These lines move the order pointer
148 move.l (a3),a2 ; into a2
149 lea wumpx,a1 ;
150 move.w (a1),d6 ;

```

```

151 lea wumpy,a1 ;
152 move.b (a1),d7 ;
153 lea seq_num,a1 ;
154 subq.b #1,(a1) ; Decreases frame count
155 cmp.b #3,(a1) ; If less than 3 frames left
156 bls.s set_4 ; then frame consists of 4 sprites
157 bsr blank_out ; ELSE remove a sprite
158 move.b (a2)+,d5 ; Read sprite number from order
159 bsr plot ; Plot frame
160 move.l a2,(a3) ; Saves new order pointer in seq_reg
161 rts ;
162 set_4 subq.w #4,d6 ; Adjusts x and y positions to
163 subq.b #4,d7 ; account for extra sprites
164 move.w d6,d0 ; Saves d6 and d7 in
165 move.b d7,d1 ; d0 and d1
166 bsr blank_out ;
167 add.w #8,d6 ; These lines remove the
168 bsr blank_out ;
169 add.b #8,d7 ; last frame of the explosion
170 bsr blank_out ;
171 move.w d0,d6 ; using 'blank_out'
172 bsr blank_out ;
173 tst.b (a1) ; If end of explosion sequence
174 beq.s ex_bang ; THEN branch to ex_bang
175 move.b d1,d7 ; Restores d7 from d1
176 move.b (a2)+,d5 ; Reads sprite number from order
177 bsr plot ;
178 move.b (a2)+,d5 ; These lines place
179 add.w #8,d6 ;
180 bsr plot ; the next frame of the
181 add.b #8,d7 ;
182 move.b (a2)+,d5 ; explosion, consisting of
183 bsr plot ;
184 move.w d0,d6 ; 4 sprites on the screen
185 move.b (a2)+,d5 ;
186 bsr plot ;
187 move.l a2,(a3) ;
188 ex_bang rts ;
189 ;
190 ;
191 ; These are sprite definitions and MUST be entered IMMEDIATELY
192 ; following the sprite definitions given in the two earlier
193 ; issues (QL USER, March and April)
194 ;
195 ; Sprite # 10 Explosion frame #1
196 dc.w $0000,$0000,$0000,$1010,$0808,$0000,$0000,$0000

197 ; Sprite # 11 Explosion frame #2
198 dc.w $0000,$0000,$3030,$0404,$0000,$4c4c,$0000,$0000

199 ; Sprite # 12 Explosion frame #3
200 dc.w $0000,$2222,$0808,$0808,$4242,$2424,$2222,$0000

201 ; Sprite # 13 Explosion frame #4a
202 dc.w $0000,$0000,$0000,$1414,$0000,$0a0a,$0000,$0000

203 ; Sprite # 14 Explosion frame #4b
204 dc.w $0000,$0000,$0000,$4848,$2020,$0000,$1010,$0000

205 ; Sprite # 15 Explosion frame #4d
206 dc.w $1414,$0000,$0101,$1010,$0000,$0000,$0000,$0000

207 ; Sprite # 16 Number '0'
208 dc.w 0,15420,26214,28270,30326,26214,15420,0

209 ; Sprite # 17 Number '1'
210 dc.w 0,6168,14392,6168,6168,6168,32382,0

211 ; Sprite # 18 Number '2'
212 dc.w 0,15420,26214,3084,6168,12336,32382,0

213 ; Sprite # 19 Number '3'
214 dc.w 0,32382,3084,6168,3084,26214,15420,0

215 ; Sprite # 20 Number '4'
216 dc.w 0,3084,7196,15420,27756,32382,3084,0

217 ; Sprite # 21 Number '5'
218 dc.w 0,32382,24672,31868,1542,26214,15420,0

219 ; Sprite # 22 Number '6'
220 dc.w 0,15420,24672,31868,26214,26214,15420,0

221 ; Sprite # 23 Number '7'
222 dc.w 0,32382,1542,3084,6168,12336,12336,0

```

```

223 ; Sprite # 24 Number '8'
224 dc.w 0,15420,26214,15420,26214,26214,15420,0

225 ; Sprite # 25 Number '9'
226 dc.w 0,15420,26214,15934,1542,3084,14392,0

227 ; Sprite # 26 Explosion frame #4c
228 dc.w $0808,$0000,$2020,$0000,$8888,$0000,$0000,$0000

229 ; Sprite # 27 Explosion frame #5a
230 dc.w $0000,$0000,$2121,$0808,$0000,$2020,$0000,$0000

231 ; Sprite # 28 Explosion frame #5b
232 dc.w $0000,$0000,$2020,$0404,$0000,$0000,$0404,$0000

233 ; Sprite # 29 Explosion frame #5d
234 dc.w $2020,$0000,$0000,$2020,$0808,$0202,$0000,$0000

235 ; Sprite # 30 Explosion frame #5c
236 dc.w $0000,$0000,$0404,$0808,$0000,$2020,$0000,$0000

237 ; Sprite # 31 Explosion frame #6a
238 dc.w $0000,$0404,$0101,$0000,$0000,$0000,$0000,$0000

239 ; Sprite # 32 Explosion frame #6b
240 dc.w $0000,$0202,$0404,$0000,$0000,$0000,$0000,$0000

241 ; Sprite # 33 Explosion frame #6d
242 dc.w $0000,$0404,$0000,$0000,$0000,$0000,$0404,$0000

243 ; Sprite # 34 Explosion frame #6c
244 dc.w $0000,$0808,$0000,$0000,$0202,$0404,$0000,$0000

245 ; Sprite # 35 Nemesis A
246 dc.w $4000,$2700,$1f00,$ff00,$*1f00,$3f00,$7f00,$1000

247 ; Sprite # 36 Nemesis B
248 dc.w $0200,$e400,$f800,$ff00,$f800,$fc00,$fe00,$0800

249 ; Sprite # 37 Life flag
250 dc.w $0010,$0038,$007c,$00fe,$1000,$1000,$1000,$1000

251 ; Sprite # 38 Barrier LH top
252 dc.w $0001,$0003,$0007,$000f,$001f,$003f,$007f,$00ff

253 ; Sprite # 39 Barrier Filler
254 dc.w $00ff,$00ff,$00ff,$00ff,$00ff,$00ff,$00ff,$00ff

255 ; Sprite # 40 Barrier RH top
256 dc.w $0080,$00c0,$00e0,$00f0,$00f8,$00fc,$00fe,$00ff

257 ; Sprite # 41 Barrier Bottom middle
258 dc.w $00ff,$00ff,$00ff,$00ff,$0000,$0000,$0000,$0000

259 end

```

SYMBOLS :

```

ex_bang R0000017B blank_out U00000000
set_4 R0000012C draws_bang R00000100
seq_num U00000000 wumpy R00000000
wumpx U00000000 seq_reg U00000000
order U00000000 explode R000000E0
zag R000000D0 mask_tab U00000000
calc_addr U00000000 crunch U00000000
vline R000000BB scrubby R00000090
rndpos U00000000 bul_hit_bar R0000008B
load2 R00000072 load1 R0000006E
loadbarriers R00000062 save2 R0000004C
save1 R00000048 base_buf U00000000
savebarriers R0000003C plot U00000000
colloop R0000001E rowloop R0000001C
bar_tab U00000000 barrier R00000014
barloop R00000008 setbarriers R00000000

```

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# quest

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SOFTWARE FROM SCOTLAND

# TRIPTYCH TRIO

**A new set of business software packages, assessed by Paolo Baccanello.**

This software, which comes from Brentwood based Triptych Publishing, has a unique flavour all of its own. The packages are part educational and part practical. The aim is to develop new skills in the user and then provide an outlet for them, hence the motto "application through learning".

Refreshingly original, Decision Maker provides a simple and ordered framework for evaluating problems. Users are required to build up a tree

Maker comes across as a useful complement to good old common sense. It encourages people to be aware of the risk element in decisions and to look for any hidden ramifications.

Of all three packages, Project Planner is the easiest to use. Here, the user is encouraged to break down a task into a number of component jobs. Each job is given a description, duration and a cost to complete. Furthermore, where a job is dependant upon others having been finished, you are required to specify them. Then the program comes into its own.

Applying the theory of Critical Path Analysis, (explained earlier on),

**"At a glance the user will be able to determine those areas where a day or two saved will be most profitable."**

of consequences stemming from one particular decision. Branching occurs whenever further decisions have to be made or when some chance event occurs.

In addition to specifying the nature of each event you are required to ascribe a monetary value and determine its probability. Having done this the program applies Statistical Decision Analysis techniques to select the optimum course of action open to you.

To introduce the concept and explain various aspects of Decision Analysis such as Bayes Theorem, Expected Monetary Value, EVSI and Maximin, a teaching course is included on two separate microdrive cartridges. This is backed up by an extensive manual containing a number of carefully worked examples.

All programs make full use of the QL's windowing and graphics capabilities and are relatively simple to use. This is particularly true of the applications program. Here a decision tree with up to 149 nodes and 5 branches to each node may be built up. A skeleton outline of the whole tree, with the optimum course of action highlighted, is displayed in one window whilst another is used to 'zoom in' on a particular node. A third window contains a command menu where options are selected simply by pressing the appropriate function key. The whole ensemble gels quite well, though with complex trees, 'zooming in' on every branch is somewhat time consuming.

With the limitations of Decision Analysis carefully explained in their manual, Triptych have avoided creating false expectations as to the program's problem solving capabilities. As a consequence, Decision

the program goes on to create a horizontal bar chart. This shows the overall duration of the project, highlighting those jobs that are critical and those where a degree of leeway in their completion is permissible. At a glance the user will be able to determine the areas where a day or two saved will be most profitable.

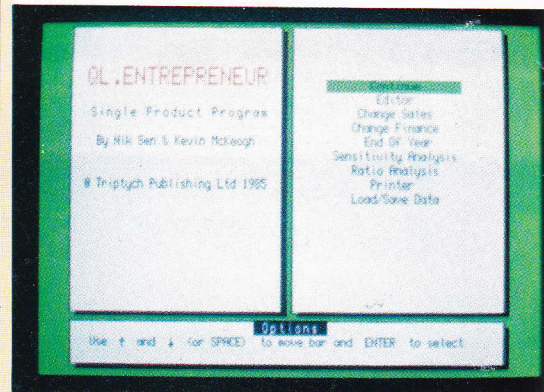
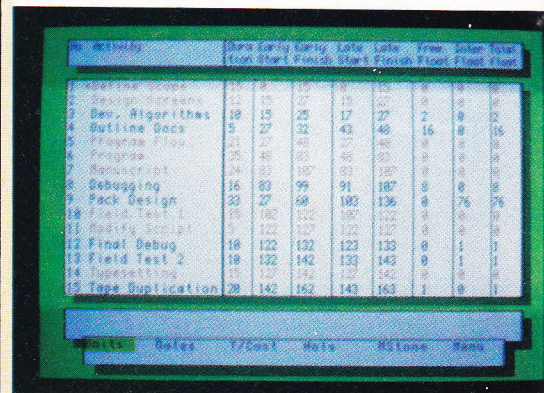
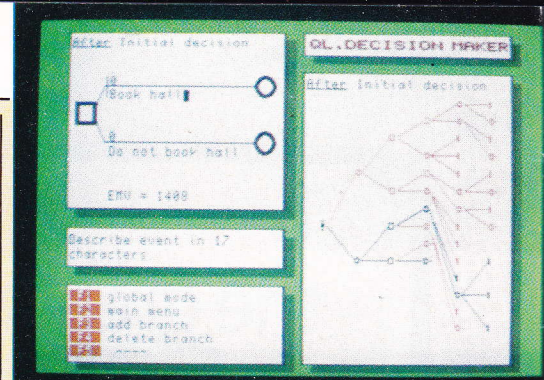
Simplicity would appear to be the keynote in this production. Just as the theory of Critical Path Analysis is relatively uncluttered, so too are the programs. Available options are permanently displayed at the foot of the screen and are accessed using the cursor keys along with [ENTER]. Finally, the program is relatively undemanding in terms of the information that needs to be keyed in. Provided that you can split a task into

**"Entrepreneur - a guided tour into the world of small business and limited finance."**

its parts and relate one to another you should encounter few problems.

Entrepreneur enables you to examine the feasibility of starting up a particular business venture. It requires reasonably detailed information concerning assets and liabilities, income and revenue as well as funding and interest rates to be entered.

After this the program will automatically examine stock levels, identify the business's breakeven point, summarise monthly cash flows and produce projected balance sheets and profit and loss accounts. Additionally it examines (debtor and creditor) repayment periods and produces a 'sensitivity' chart which shows how +/-10% variations in each item of income or expenditure affects profits. This is particularly useful in identifying areas with a disparate influence



on the business's well being.

The program's extensive manual not only documents the software and introduces various simple accounting and business analysis techniques, but also lists the many problems that surround starting up a business in the real world.

The appeal of Entrepreneur is akin to a guided tour into the world of small business and limited finance. Input routines, though slow are carefully graded so that the user is systematically led from one area to the next and forcibly prevented from omitting a single figure. However, as a tool - as opposed to an education - there's little in the program that could not be duplicated using a spreadsheet such as Abacus.

Overall, distinguished by the fact they treat users as human beings, Triptych's programs make a welcome addition to the QL's repertoire.

Decision Maker	£39.95
Project Planner	£39.95
Entrepreneur	£39.95

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quest

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Days 111	Year 1985	Delete line	Print file	
Updated 1985 April 11		Finish edit	Export file	
WEDNESDAY MAY 15		MAY 1985		
Hour	Appointment/Memo	Mo	Tu	We
01	09:15 MEET JACK	01	02	03
02	09:45 CALL BROKER	06	07	08
03		13	14	15
04	11:11 SEND CABLE TO USA	20	21	22
05		27	28	29
06	13:30 LUNCH			
07		JUNE 1985		
08	14:10 PHONE FRANCE	Mo	Tu	We
09		01	02	
10	16:00 EDITORIAL MEETING	03	04	05
11		10	11	12
12	17:10 CALL HONG KONG	17	18	19
13		24	25	26
14	18:10 DINNER WITH SHEILA	27	28	29
		30		

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# MONOCHROME

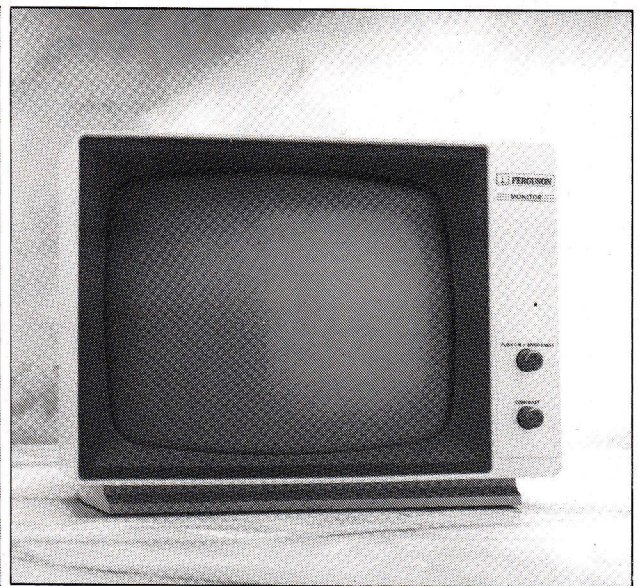
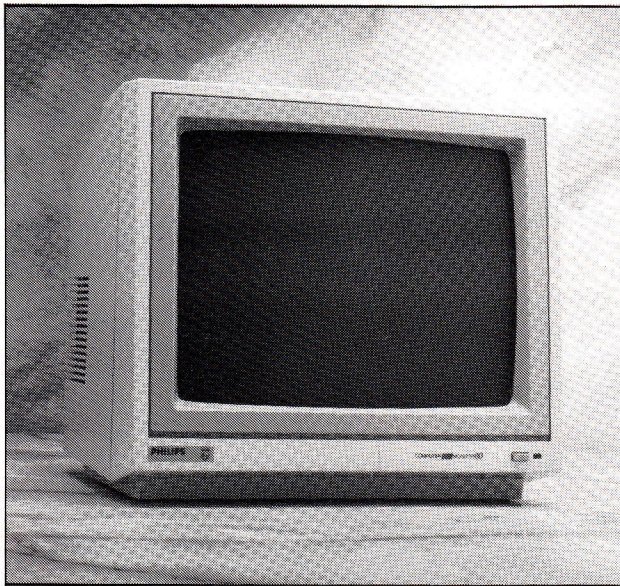
PHILIPS  
BM 7502

Zeal Marketing £92

FERGUSON  
MM 02

Ferguson £80

# MONITORS



Colour monitors provide the ultimate in displays for the QL, but with prices up to £300 they can deplete even the largest of wallets. Normal TV sets, however, hardly provide an alternative and so a third category has arisen - Ralph Vernon assesses two examples.

With 32K of memory devoted to screen handling, it's not surprising that the QL's video display rates amongst the top three in the personal computer field. However, as a domestic TV set cannot support the 512 by 256 pixel display with its unique 85 column text format, a dedicated monitor is a must.

Not surprisingly, as with TVs, monitors break down into two groups, monochrome and colour. The latter tend to be two to three times the price of the former. For the business user, the £150 or so premium paid for colour hardly justifies a benefit that in most cases is little more than cosmetic. This is especially true when one considers that the low cost of a QL will have attracted him to the machine in the first place.

In terms of screen resolution and image quality monochrome monitors, in general, compare very favourably with the coloured variety. Certainly, with the two monitors reviewed both Quill documents and Abacus spreadsheets were easily legible in 80 column mode. Additionally, the red and green of the programs' command lines were clearly distinguishable as different shades of green or amber. However, in 40 column mode where 8 colours are normally available we had difficulty making out the varying hues of colours adjacent in the spectrum. As this mode is unlikely to be used for anything other than games

software, the problem is likely to go unnoticed.

Finally, before looking in detail at two monitors currently available for the QL, readers should note that most monochromes use green or amber phosphors and not white, which produces a far harsher display. The choice between these colours depends on individual tastes rather than any qualitative difference.

## Stylish Partner

At first sight, Ferguson's MM02 12" monitor seems ill matched alongside the QL. Its chunky appearance and rounded edges are at odds with the computer's lean hi-tech lines. A disparity in style that is aggravated by a two-tone pastel brown colour scheme. Looks, however, can be deceiving.

On the technical side, the monitor has little trouble coping with the QL's idiosyncratic display. A bandwidth well above the minimum 18Mhz required to handle the high resolution display augurs well. Additionally a fast flyback time of eight microseconds ensures that it can cope with 85 characters per row.

In operation picture quality is good with screen flicker at a barely noticeable minimum. Characters are crisp and shades of grey discernible. An anti-glare faceplate reduces unwanted reflections and operator fatigue. Also, brightness and contrast (front right), dynamic focus and image height controls (rear) allow considerable play in varying luminosity and picture size.

Two minor niggles, however, mar an otherwise good performance. On an 85 column display, characters tend to lose themselves behind a curved plastic surround at the edges of the screen. This can only be countered by reducing the image

height by a third. And neither raised nor angled, the screen falls below the level of the QL's keyboard.

## An Odd Couple

Despite an off-white and grey colour scheme, the sleek modern styling of the Philip's BM 7502 12" makes it a fitting companion to the QL. Great care has been taken to ensure that there are no redundant surfaces. The unit is compact and uncluttered.

Technically there is little to fault. Bandwidth and line flyback times both exceed the QL's minimum requirements. An internally etched anti-glare screen ensures that characters are easily legible and unwanted reflections do not interfere with the display.

Controls, though unobtrusive are comprehensive. Contrast, brightness and sound are hidden away in a small compartment at the front of the machine. (Sound, of course, is lost on the QL as the computer has no external audio output socket). Additional controls recessed at the rear permit one to straighten the image, vary picture width, height and stability and move it to the left or right.

Particularly attractive, the monitor has a movable support which tilts the display above the level of the QL's keyboard, leaving the controls easily accessible and the screen inclined at the optimum reading angle.

In use there is little to complain about. Characters are clearly legible at all points on the screen. The green phosphor display is easy on the eye even over protracted periods of time. The image is very stable and screen flicker virtually imperceptible. Also, despite little travel on the brightness and contrast controls, few problems are encountered in distinguishing the different shades of grey.



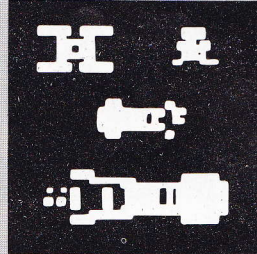
## Quest's powerful new Sprite designer for the Sinclair QL

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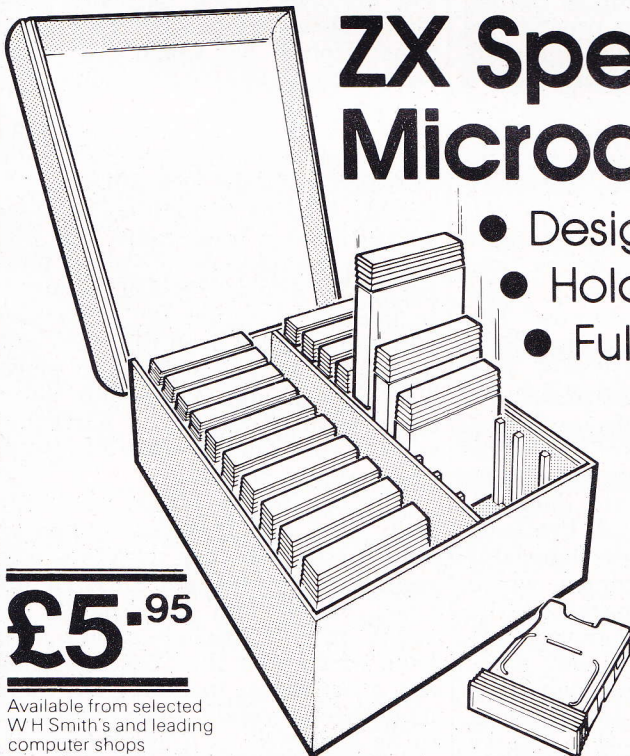
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# DIGITAL

## IN PROFILE

What have MENSA, international tax law and the QL got in common? Answer: Freddy Vachha – the latest in a line of young men who have sought fame and fortune through setting up their own software houses in the front room and waiting for the money to come rolling in. He's 27, enthusiastic and convinced that not only is the games market *not* finished, but that his company's programs are the best available, and will continue to be so. Thereafter, he breaks the mould.

Mr. Vachha is neither flash nor foolish. Apart from being the reigning MENSA chess champion, ("MENSA is an essentially trivial organisation"), he holds first-class honours degrees in Maths and Physics, and a Distinction in Accountancy and Business Studies from a London Polytechnic. He lectured for two years in Physics and Electrical Engineering and later set up his own computer software consultancy, dealing with database design and international tax matters for large corporations. It's a highly specialised field because, as Freddy Vachha says, not many are masochistic enough to become proficient in it. He is formidably knowledgeable about computers, computer languages and software applications, and convinced that the QL is the Rolls Royce of the

**"Poor software is feeding the QL very, very badly – it's giving it a bad press . . ."**

micro-market. He is also convinced that it is at present badly served by the software packages available, and that only through the kind of professionalism he practises will programs become worthy of the machine.

Vachha's company is called Digital Precision, and emphatically not, he says, "a software house of last resort, as it has been for many people who leave school, and start a software house. We're not operating with a small share capital and a huge gearing ratio, that is people can foreclose on our debts: we're not borrowing

money at all. I'm sufficiently in credit for my bank manager to be sycophantic."

The company was formed nine months ago, and advertised discreetly for programmers without using the name Digital Precision, and without "exciting the unhealthy interest of software authors and journalists". From those who answered the advertisements, Digital Precision compiled a database of potential authors, however most that is submitted for consideration is rejected. "This is not uncommon, except for the QL. At the moment, people are accepting anything for the QL on the basis that anything sells. Firstly, that's not the sort of thing we like to do, and secondly, it doesn't pay dividends in the long run, being associated with bad quality software from the beginning."

Even programs regarded as excellent are subject to amendments, and if the author is unwilling to change small details, then the program is likely to be dropped, "on the grounds that we're not just quibbling. We're not just packaging software sent in to us. We can give very real technical assistance – machine code programming is an art in itself. Sinclair's very poor documentation for the QL makes it difficult, but for an author who doesn't have the resources, time or data, we can and will help, if the program is being offered to us." The reason for all this is simple. "Poor software is feeding the QL very, very badly. It's giving it a bad press, and the QL is a Rolls Royce of a machine."

Mindful of the criticism heaped on companies which hype non-existent goods in order to create demand, Freddy launched Digital Precision with The QL Super Sprite Generator and QL Super Backgammon, which he claims are, "three programs of the very highest quality. We never, never compromise here. All our programs will have the same high standards of documentation, instructions, packaging and presentation and we will price them attractively." Only Psion's Chess program comes up to Digital Precision's standards: "It's professionally done, compact, very

fast and there's nothing around to beat it. It's the only piece of software which we would place in the same rank as our own Super Monitor or Sprite Generator."

This is not a satisfactory state of affairs, in Mr. Vachha's opinion. "We welcome quality competition, but don't see any around at present, barring Psion."

Reluctant to disclose details of packages currently being prepared he sees the opposition as unscrupulous as well as incompetent! "We would not want to encourage

**"Why buy an Amstrad with Z80, when you can have a full-blown 68000 in the QL"**

unhealthy competition – I'm thinking of people producing bodged versions of some software and just pre-releasing it, purely to spoil the market for someone else. There are examples of this – it happened in the Spectrum days with compilers. Once it was realised that a really professional compiler was coming out, quite a few people got together and brought out versions which basically spoil the whole compiler market for a long time. Hence, we won't talk about something unless we have something physically tangible."

As the author of some half-dozen arcade games for the Spectrum, some of which made the best-seller charts, Freddy Vachha is qualified to judge what makes a good game, but why does he intend to devote about forty per cent of Digital Precision's output to intelligent games for a machine which has never been regarded as a games computer? In the first place, Mr. Vachha argues, Sinclair never aims a machine for a particular market, but launches the hardware and waits on results.

The Spectrum's image was originally that of a 'serious' computer, with initial software packages concentrating on utilities, such as Vu-Calc, Vu-3D and Vu-File. In the event, more first-class games have been written for the Spectrum than any other micro, including the Commodore 64. Secondly, even if the QL is to be regarded as a small-business machine, there are precedents for writing games for it. "IBM, Olivetti, Compaq and a whole host of other machines, they're definitely business



# PRECISION

machines, but adventure and arcade games are selling very well for them. Why? Because even people using it for business or other 'serious' purposes will take advantage of the availability of good games. Why buy a small home computer which probably runs on a Z80 anyway, like the Amstrad, when you can have a full-blown 68000? For the speed of the 68000, refer to our Sprite Generator!"

The fact that other software houses are not producing games for the QL doesn't worry him. "It's not that they know something that we don't, it's just that writing for the QL is more demanding than writing for, say, the Spectrum. To take full advantage of all the many features of the QL requires more dedication and discipline from the programmer. Software houses used to churning out programs for the Spectrum, Commodore and Amstrad find it difficult to realign themselves. They're just not geared up to the QL yet. It demands a totally separate machine code, and the definitive programs have not yet been written for it. But when it happens the standard will be far higher than programs for the 8-bit machines."

Clearly, the very fact that writing for the QL is complicated is part of its attraction for Mr. Vachha. "The QL is a very respectable machine, in terms of its specification. The 68000 is the CPU of the future. Just because it has been knocking about for four or five years without getting any exposure doesn't mean it's out of date. It wasn't given a fair trial in the beginning, because it was shut out by IBM, whose subsidiary INTEL, manufactures the 8080, which has dominated business systems for the last five years. Only now are good 68000 systems appearing, based on computers like the Sage and the Macintosh. And the Macintosh graphics are really superb."

Now, we can do things like that on the QL, too. Any doubters should refer to the Sprite Generator! We can currently compete with the Macintosh graphics - the Macintosh costs about £2000 for a very basic model. The QL plus disc drive is about forty per cent of that."

Nor does the existence of many different versions of the QL disturb him. "For non-professional software houses, that matters a lot. It doesn't matter for us. We have yet to hear from anyone, even people with very

early models of the QL, who've had problems. We tend to write on AHs and JMs, since those account for 80% of the machines out there. We virtually guarantee compatibility for existing machines. We can't guarantee it for future versions of the QL, but we'll make sure our software is compatible very shortly after Sinclair's released it, unless he re-writes the entire ROM, which Sinclair Research doesn't have the facilities to do, as amply demonstrated when they were writing the original QL ROM!"

Digital Precision has neither sought nor received help from Sinclair. On the technical side, Freddy believes that he could probably help Sinclair. "If we'd been writing the ROM software, we'd have got a full-screen Editor into BASIC, and put Quill into the ROM, as well." Neither does he hanker after a Sinclair badge for his products. "Having already won a Sinclair Badge for a piece of software I wrote for the Spectrum, I can say with complete honesty that I have absolutely no misgivings about not having one."

Games will not account for the whole of DP's output. Utilities and business packages will account for forty per cent, with the remainder being devoted to educational programs. As an accountant, Mr. Vachha thinks that one of the QL financial packages currently on offer has good graphics. So far as content is concerned, "anyone considering it would be well advised to consult his auditor or the Inland Revenue first, or consider very carefully the consequences of losing his entire sales ledger overnight."

## **"I strongly disapprove of the Stock Exchange - it's protectionist and Victorian"**

All is not, however, unalloyed praise for this most contentious of Sinclair's children. It suffers, says Freddy, from an indifferent operating system and, of course, from an unreliable storage medium. Digital Precision has the answer to the difficulties created. All DP programs are loaded in one go, right at the beginning, and then the micro-drive cartridges are ignored for all time, by using RAM files for necessary data manipulation. As for the operating



system and interpreter, DP's policy of using machine code wherever possible has the effect of by-passing them almost totally, thus eliminating virtually all the side-effects of the QL's shortcomings. BASIC he describes as "the carthorse of computer languages" and one which should be used as sparingly as possible, and since he is proficient in BASIC, Pascal, FORTH, COBOL, RPG, FORTRAN, LISP, PROLOG, and C as well as common or garden machine code, he's entitled to his opinion!

Having put money where his faith in the QL is, he also has his opinion of the Stock Exchange. Their lack of confidence in the home-micro market recently led to a drop in share values, when Amstrad announced record profits due to the success of the CPC 464. "I strongly disapprove of the Stock Exchange - it's a protectionist, archaic and Victorian organisation, highly inefficient, non-electronic and way behind the rest of the world. That's why New York and Hong Kong are far ahead of us. Financial circles decided that the Long Playing record was a failure. There are a number of other examples. The Stock Exchange's lack of confidence in the software industry is definitely a good omen!"

So far as Digital Precision is concerned, Freddy Vachha could well be right. As he says, the proof of the pudding, or in this case, the software, is in the testing. Accountancy's loss may well turn out to be the QL's gain.

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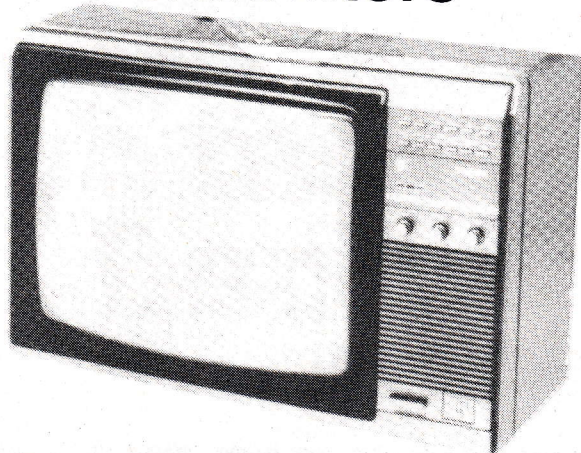
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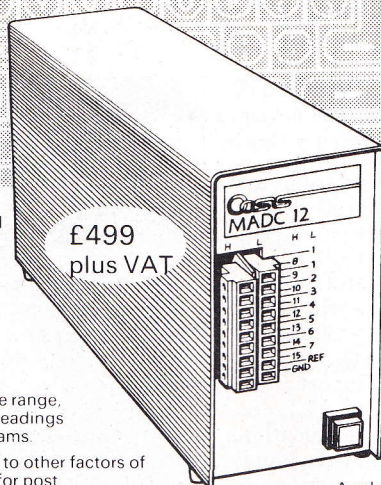
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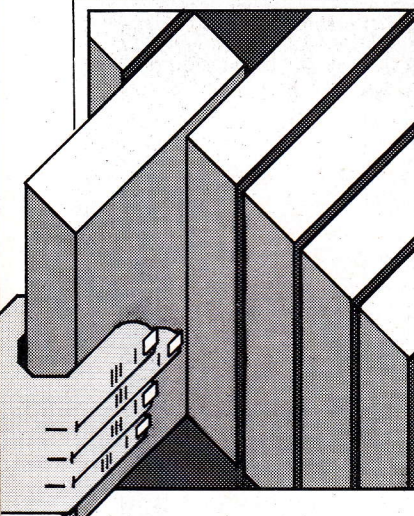
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## Nicky Trevett peruses what's in print to see if it makes the grade.

Plenty of books based on the four Psion applications that come with the QL have made their appearance, but few have devoted much space to the transfer of files between programs. Alison McCallum-Varey's *Quill*, *Easel*, *Archive* and *Abacus* on the Sinclair QL, published by Sunshine at £6.95, attempts to redress the balance.

Subtitled 'Integrating the Psion Software', it is readable and covers a lot of ground. Perhaps too much. It seems to be aimed at newcomers to the Psion packages, as well as those who can use the programs but would like to know how to integrate them effectively. It starts, for example, by carefully defining what it means by 'integration' – the ability to take the same set of data and use it in several different packages – and tries to advise on when you should integrate, and when you shouldn't.

There is a lengthy chapter introducing the QL and each of the four programs separately, but anyone who needs a real down-to-basics introductory guide would be better advised to read one of the many books devoted to providing just that. You should not really attempt file transfer before fully conversant with the way the programs work individually.

Having said that, the section of the book concerned with integration is well organised and easy to follow. It starts with one-to-one file transfer – the moving of data from *Archive* to *Quill*, for example – and then moves on to full-scale integration, using for demonstration purposes a diet plan and a company's credit control system to show how all the Psion applications can be

used together to "provide solutions to complex problems".

The author has very helpfully included a summary chapter which lists step-by-step the procedures involved in transferring files from *Archive*, *Abacus* and *Easel* respectively to the other three programs (you can't transfer information from *Quill*), along with the rules of *Import* and *Export* of data. And while on the subject of communications, she has even included a handy, if sketchy, introduction to hardware communications, getting QLs to talk to one another.

## Micro Mock-Ups

If you want to try something a bit different with your QL, how about a spot of simulation?

According to John Cochrane's *Introduction to Simulation Techniques on the Sinclair QL*, also published by Sunshine at £6.95, simulations are special purpose programs designed to duplicate the workings of the real world. Which, of course, covers a huge area – everything from programs to train and test airline pilots, forecast weather, predict election results, design oil rigs... the possibilities seem endless.

There is even an overlap with Artificial Intelligence (simulation of the workings of the human brain), and of course many games are based on a crude form of simulation, like tank battles.

As the author points out, there is a limit to what you can do with a home computer due to memory restrictions and comparatively slow processing, but the QL with its 68008 chip has more potential than most. This book aims to introduce experienced users to some fundamental simulation techniques which should allow them to develop useful programs – perhaps customised business simulations.

The first three chapters look at the theories behind simulation, like 'systems thinking', operational analysis, emulation and analytical simulation,

predicators, and the various processes – Monte Carlo, Deterministic and Markov Chain. There's a chapter examining the potential of the QL and the way its features and parts are brought into play, then on to more specific applications.

The book concentrates on five main application areas: financial modelling, testing (of mechanical parts, for example), project planning, simulating the unknown (the weather!), and real-time simulation (as exemplified by games). Each chapter ends with a sample program for you to key in and try, listed in *SuperBasic*.

It's different, and some of it may even prove of use if you run a business.

## Basic Maths

If, on the other hand, you are of a mathematical bent, you could try dipping into Czes Kosniowski's *Mathematics on the Sinclair QL*, again by Sunshine priced at £6.95. This claims to explain all the mathematical functions available on the QL, like *INT*, *LEN*, *ABS*, *SIN*, *COS*, *TAN* and so on, as well as such programming techniques as arrays.

restricted to those with programming experience and a certain amount of mathematical know-how, who might want to include the QL's mathematical utilities in their programs. There are no concessions to the beginner whatsoever – the first chapter, entitled 'Some Simple Routines', is likely to leave most novice programmers floundering. And if, mathematically speaking, you're dubious about integers and integral parts of numbers, forget it. That's what you're faced with in the very first sentence.

For those eager to dust off their O-level maths, however, there's a great deal of meat here. All the mathematical functions covered are illustrated with short programs listed in *SuperBasic* (using Mode 8) which can, if appropriate, be incorporated into your own programs.



# BOOKMARKS



Topics covered include trigonometry (scale drawings, estimating heights and distances, Pythagoras' theorem etc), earth trigonometry (lines of longitude and latitude, calculating distances), powers, sequences, number bases, primes, matrices, codes, random numbers, and more. Not to mention the Sieve of Eratosthenes!

The book is written by a lecturer and there's a certain text book flavour about it. However, it looks good value given the huge amount of information contained in its pages.

## At The C-Side

With one compiler out and another due in May interest in the C programming language is hotting up. It is too early to expect a book dedicated to C as implemented on the QL, but here are two more books which have a lot to say about the C language in general.

*Programming in C* by Robert Traister is another extraordinarily expensive soft-backed book, published by Prentice-Hall at – take a deep breath – £19.50. But while it can't offer the authoritative input of C author Dennis Ritchie, it's a much more down-to-earth introduction to the language and aimed specifically at microcomputer users. As the author says, the book was written to serve as a primer to the C language. But you will still require solid experience of BASIC and a serious interest in programming to get anything of value from it.

The book starts with a look at the C language in general, and a C compiler – specifically, the Supersoft C compiler, which was designed for use with such microprocessors as the 8086 and 8088 and the Z80 and Z8000.

From chapter three, it's down to basics as the author introduces you to some of the principal functions and statements, drawing parallels throughout with BASIC. You are soon set to writing simple programs, although these tend to be rather abstract in nature

– designed to perform mathematical calculations, for example.

Although emphasised several times that the book is for practical use by microcomputer users, the style is a little dry, and the content very inward-looking. The (many) programs provided for practical demonstration tend to relate to abstract calculation and bear little relation to practical, business-orientated applications. There is, however, a set of useful appendices at the back, although most of the space is devoted to the Supersoft compiler's standard library functions.

*The Big Red Book of C* by Kevin Sullivan is priced at a much more reasonable £7.50, although it's hardly a big red book. More a small, compact red book.

Published by Sigma Press, it attempts to do much the same as *Programming in C*; namely, introduce the programmer new to C to the language's basic commands and statements. Here, however, there is greater emphasis on applications, like file handling, printer drivers, sorting and so on. It is also easier to find your way around this book, since it is divided up into more chapters, each focussing on a specific area of C.

Thus there is a brief introduction to C, followed by a look at control loops, data types and operators, files and filing methods, printed output and printer drivers, direct access files, command line programs, structures, and sorting methods.

Like Robert Traister's book, *The Big Red Book* is packed with example programs, but there are no appendices at the back. The programs are based on two C compilers rather than one, which (the author hopes) means most of the listing will run under PC-DOS or MS-DOS and CP/M-80 or 86.

The book is also the cheapest guide to C I've yet seen, although some of the savings seem to have been made on presentation – the text, for example, is small and unpleasantly cramped.



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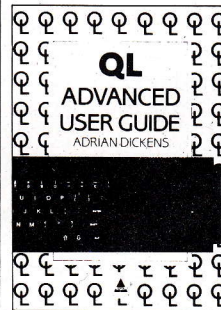
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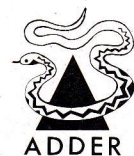


"An excellent reference book... a stepping stone to the heart of the QL." Sinclair User, January 1985.

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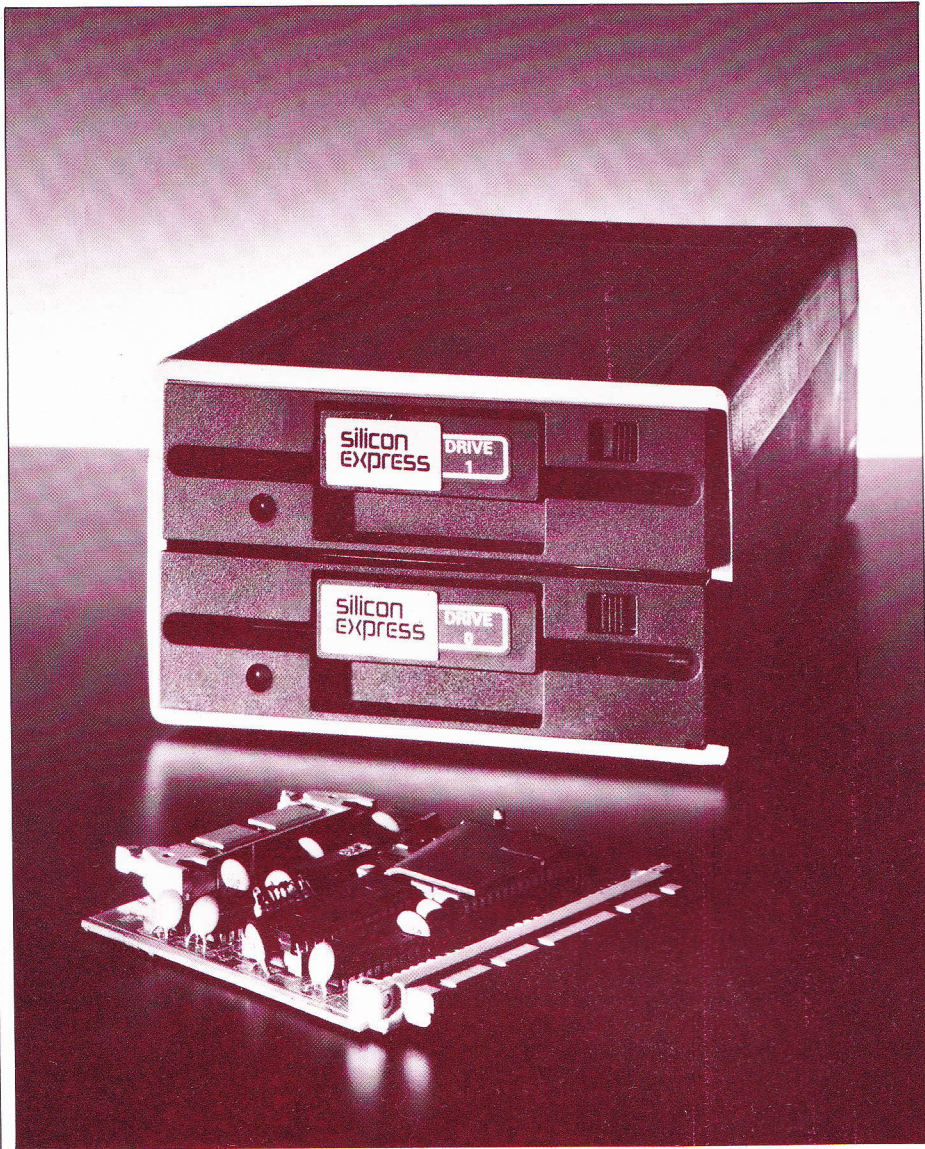
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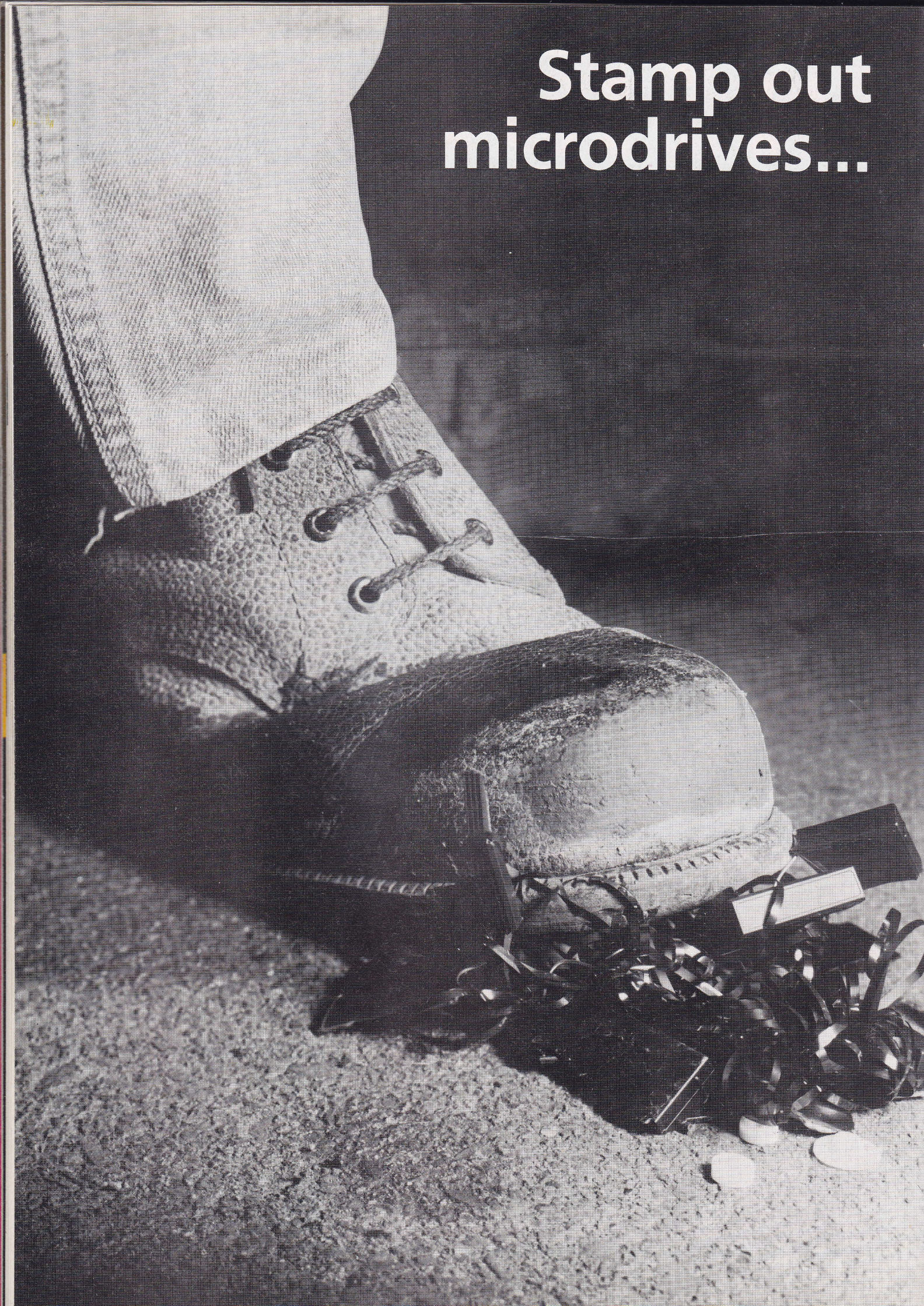
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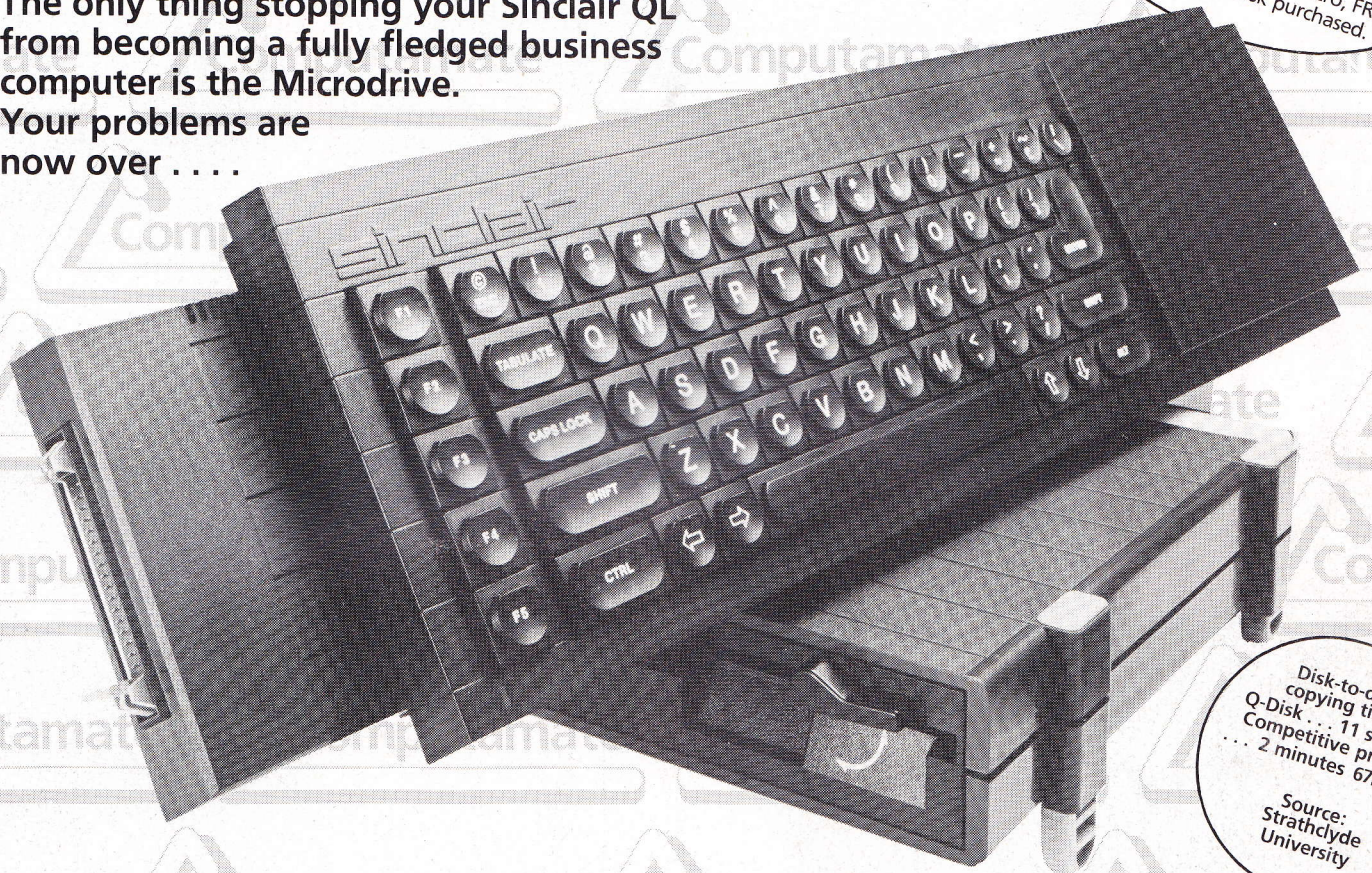
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# AI ON THE QL



ILLUSTRATION BY PAUL ALLEN

# THE SECOND PART OF MIKE JAMES'S PENETRATING INSIGHT INTO ARTIFICIAL INTELLIGENCE ON THE QL.

Last month we introduced the idea of a heuristic, that is a collection of rules that when applied to a problem bring us closer to its solution. The problem that we considered was *static* in that it didn't change in response to our attempts at solving it. In reality, however, problems are rarely as simple as this and usually fight back to spoil our solution. A clear cut example is any competitive game such as draughts or chess. When playing against an opponent, it's not good enough to adopt a heuristic and use it without taking into account the effect that it has on your opponent's moves.

Many chess novices have tried the 'make the same move as the opponent just made' heuristic or some variation just for fun and discovered that their opponent wins in very few moves. But why? If your opponent is using a heuristic that he expects will win, then why not copy it? The answer is of course that such competitive games are not played by considering each move in isolation. Each move is in fact evaluated in terms of what moves the opponent can make in reply to *undo* the immediate advantage that the move creates. In other words, the interaction between players is much more subtle and complex than anything we have considered so far.

Although games do provide a very clear example of one intelligence in competition with another, it should be noted that this is an important component of the way humans interact with one another. In other words our behaviour takes account of how it will effect others. If computers are ever to become intelligent then we must attempt to incorporate this type of interaction into the heuristics they use. Most AI research into this area has used games such as draughts and chess as examples of intelligent competition and as a result, such research is often regarded as a frivolous activity. However, if what can be learned from making computers play these games can also be applied to computer/human interaction, then it is far from frivolous and takes us a step closer to the intelligent computer.

## Levels Of Difficulty

It's difficult to find problems that will serve as adequate examples - most either turn out to be too difficult to understand quickly, or too easy to present any challenge to the method under discussion. A game that provides just the right level of difficulty is 'noughts and crosses'. This is the most difficult two-person game that can be programmed in SuperBasic in a small enough number of lines to be readily understood. It also has just enough variety to illustrate some of the more advanced AI techniques.

Before going on, try to refresh your memory of the sort of considerations that govern the play. Assuming you are playing 'O', the object of the game is to place three 'O's in a line (along a row, a column or a diagonal). Obviously, along the way to a winning position any line that could be converted into a winning line is a good thing to have. For example, two 'O's and a blank or one 'O' and two blanks in a line are good positions. However, as this is a two-person game you cannot place your 'O' just to gain an advantage, you may have to play to block a line that your opponent is building and likewise he will play to block you. This is the new element of interaction that is characteristic of competitive games.

To begin writing a program that plays noughts and crosses, the first thing we need is a heuristic that can be used to evaluate a move in terms of the immediate gains that are produced. It should be clear that such an evaluation should be based on the number of lines of one and two 'O's that a move produces. In fact if you count:

- o1 = the number of lines of 1 'O'
- o2 = the number of lines of 2 'O's
- o3 = the number of lines of 3 'O's

that a move produces you should be able to decide how good it is. But what about the lines that 'X' is building up? There would be little point in making a move that resulted in a line of two 'O's if it also resulted in a line of two 'X's. (The reason for this is simple - at the next move the line of two 'X's will be converted to a line

of three 'X's and the game will be over!) To evaluate a move it is obvious that some information about 'X's current position has to be incorporated. In the same way that 'O's position can be summarised by counting lines of 'O's, 'X's position can be summarised by counting lines of 'X's:

- x1 = the number of lines of 1 'X's
- x2 = the number of lines of 2 'X's
- x3 = the number of lines of 3 'X's

To arrive at an evaluation function, we have to find some way to combine the individual measures of how things stand into a single number that will increase as 'O's position gets better and decrease as 'X's position gets better. The simplest method is to add together each measure with an appropriate plus or minus sign. For example, we could use:

$ev = o3 - x2 + o2 - x1 + o1$   
which combines o3, o2 and o1 as measures of how well 'O' is doing and x2 and x1 as measures of how badly 'O' is doing. (Notice that there is no need to include x3 because if there is a line of three 'X's the game is already over!) The limit of this evaluation function is not difficult to spot - it ignores the relative importance of the different measures. For example, a single line of three 'O's is worth more than anything because a move that produces this result is a winning move! We can easily build in the relative importance of the measures by multiplying each of them by a constant. That is, the evaluation function is:

$$ev = a*o3 - b*x2 + c*o2 - d*x1 + e*o1$$

and our only remaining problem is to establish values for a, b, c, d, and e. Very often it's the case that such an evaluation function is the sum of a number of different measures with each weighted according to their importance. As a line of three 'O's should be valued above anything else, a should be large enough to 'swamp' the effect of all the other measures if 'o3' is 1 or more. As it's only the relative sizes of a, b, c, d and e that are important we might as well start by fixing a at some value, say 128 (computers like numbers that are powers of two!).

The values of B, C, D and e are more difficult to arrive at. Obviously, x2 is the next most important measure because a move that leaves a line of two 'X's is a very BAD move. Hence the value of b should be large but not so large that it interferes with the effect of a\*o3. If 'O' has a three row it's not difficult to see that there can be at most two lines of two 'X's, so as long as  $2*b < a$ , the presence of three 'O's will make itself felt over the presence of two 'X's. (If there is one line of three 'O' and two lines of two 'X's there can be no lines of one of anything to upset the evaluation.) Therefore a suitable value for b is 63. By similar reasoning we can arrive at values of c = 31, d = 15 and e = 7 giving the evaluation function its final form:

$$ev = 128*o3 - 63*x2 + 31*o2 - 15*x1 + 7*o1$$

This will indicate how good any possible move is and can be used to play a game of noughts and crosses in the same way that the evaluation function was used to solve the tile game in last month's article, ie, each time you have a move, use the evaluation function to pick the best one. This is a good way to start on a noughts and crosses program but, before moving on to consider it in detail, it's worth noting that assigning values to the weightings a to e is often a matter of trial and error. If using an evaluation function results in too many lost games then the weights will have to be adjusted.

## Basic OXO

Using the evaluation program, it is very easy to write a simple noughts and crosses program. Apart from the difference in details, it follows the same lines as the tile program given last month. First 'X' (the human) is allowed to make a move, then every possible reply that 'O' can make is evaluated. The move selected is the one that results in the largest value of the evaluation function ie, 'maximises' it.

The resulting program is not as long as you might expect. Once again it is written as a collection of procedures so it should be easy to use as a 'test bed' for any ideas that you may want to try out. The table over the page shows its structure (some procedures and terms

# AI ON THE QL

that it uses will be introduced later).

Procedure	Description
init	Sets up game
t_move_tree	Two-ply search of the move tree
eval_func	Calculates evaluation function
o_move_tree	One-ply search of the move tree
x_move	Gets 'X's move
print_board	Prints board

The main program (lines 10-999) is simply a list of procedure calls. Procedure init is a general set-up routine. Procedure x\_move gets and carries out 'X's move. Procedure print\_board prints the board. The evaluation function is calculated by procedure eval\_func which is called by procedure o\_move\_tree for each possible move 'O' can make in reply to 'X's move. Details of the program are fairly straightforward once you know that the board is in fact represented by two different arrays, 'A%' and 'B%'. 'A%' is used to record 'X's position and 'B%' records 'O' positions. This use of two arrays allows both an 'X' and a 'O' to be represented by '1' and simplifies some of the calculations. Procedure eval\_func calculates the evaluation function for the board as it stands. So, to evaluate a possible move, it is necessary to actually make it before calling procedure eval\_func and then to remember to unmake it. Although there are many ways of speeding up the

calculation of the evaluation function, procedure eval\_func is written to be clear rather than fast and works by counting how many of each symbol there are in every row, column and diagonal. The array X% is used to count how many lines of no 'X's there are (in X%(1)), how many lines of exactly one 'X' there are (in X%(2)) and so on up to X%(4) which counts the number of lines of three 'X's there are. Similarly, the array Y% counts the number of 'O' lines there are. The program prints out the evaluation function for each move that it considers for general interest and prints 'OCCUPIED' if a position is occupied and therefore not a potential move.

No attempt has been made to 'finish' the program (eg, there is no check for valid moves or for the end of the game) so there is plenty of scope for improvement. However, even in its present form it is sufficient to investigate how good the evaluation function is. Playing a few games against this simple program may

surprise you at how good it is! But this is more a reflection of how simple a game noughts and crosses is rather than how powerful the method is. However, there is at least one game that the program loses and it's only by studying examples where the program fails that it can be improved. If 'X' plays 1,1 the program responds with 2,2. If 'X' then plays the rather odd move 3,3 the program responds with 3,1 resulting in the following position:

X		O
	O	
		X

and all is lost because X then plays 1,3. 'O' responds with 1,2 and 'X' wins by playing 2,3. If you think about this game for a moment it will become clear that the reason that the computer loses is that it fails to take into account the possible moves that X can make. Although each move that the computer makes is a good one in terms of immediate gains, it's the move allowing the human opponent to play an apparently poor move that wins the game!

## Minimaxing

One way to improve the heuristic's performance is to extend its application to look ahead and see what the effect of each move will be on subsequent moves. For a problem such as the tile game described last month this is relatively easy. All you have to do is to examine and evaluate not only the state of the board after one move but after each of the possible subsequent moves. Using an evaluation function to look one move ahead is called a 'one-ply search', and using it to look two moves ahead is called a 'two-ply search' and so on. Using this jargon, our current version of the noughts and crosses program implements a one-ply search and we need to extend it to a two-ply search. The only trouble is, the next move is determined by the human opponent and out of the program's control. You may feel at this point that there is nothing we can do because, although we can evaluate our own next move, trying to

## PROGRAM 1

```

10 REMARK NOUGHTS AND CROSSES
20 WINDOW 452,236,60,20
30 MODE 8
40 init
50 REPEAT game
60   x_move
70   print_board
80   o_move_tree
90   print_board
100  IF INKEY$(0)="Q" THEN EXIT game
110 END REPEAT game
999 STOP

1000 DEFINE PROCEDURE init
1010 DIM AX(3,3),BX(3,3)
1020 DIM XX(4),YX(4)
1030 print_board
1999 END DEFINE init

4000 DEFINE PROCEDURE eval_func
4010 FOR K=1 TO 4
4020  XX(K)=0
4030  YX(K)=0
4040 END FOR K
4050 FOR L=1 TO 3
4060  SX=0
4070  TX=0
4080  FOR K=1 TO 3
4090   IF AX(L,K)=1 THEN SX=SX+1
4100   IF BX(L,K)=1 THEN TX=TX+1
4110 END FOR K
4120 IF SX=0 THEN YX(TX+1)=YX(TX+1)+1
4130 IF TX=0 THEN XX(SX+1)=XX(SX+1)+1
4140 END FOR L
4150 FOR L=1 TO 3
4160  TX=0
4170  SX=0
4180  FOR K=1 TO 3
4190   IF AX(K,L)=1 THEN SX=SX+1
4200   IF BX(K,L)=1 THEN TX=TX+1
4210 END FOR K
4220 IF SX=0 THEN YX(TX+1)=YX(TX+1)+1
4230 IF TX=0 THEN XX(SX+1)=XX(SX+1)+1
4240 END FOR L
4250 diag_1
4260 diag_2
4270 EX=128*YX(4)-63*XX(3)+31*YX(3)-15*XX(2)+7*YX(2)
4299 END DEFINE eval_func

4300 DEFINE PROCEDURE diag_1
4310 TX=0
4320 SX=0
4330 FOR K=1 TO 3
4340  TX=TX+AX(K,K)
4350  SX=SX+BX(K,K)
4360 END FOR K
4370 IF SX=0 THEN XX(TX+1)=XX(TX+1)+1
4380 IF TX=0 THEN YX(SX+1)=YX(SX+1)+1
4399 END DEFINE diag_1

4400 DEFINE PROCEDURE diag_2
4410 TX=0
4420 SX=0
4430 FOR K=1 TO 3
4440  TX=TX+AX(4-K,K)
4450  SX=SX+BX(4-K,K)
4460 END FOR K
4470 IF SX=0 THEN XX(TX+1)=XX(TX+1)+1
4480 IF TX=0 THEN YX(SX+1)=YX(SX+1)+1
4499 END DEFINE diag_2

5000 DEFINE PROCEDURE o_move_tree
5010 MX=-256
5020 FOR J=1 TO 3
5030  FOR I=1 TO 3
5040   IF AX(I,J)=1 OR BX(I,J)=1 THEN
5050    PRINT "OCCUPIED"
5060  ELSE
5070   BX(I,J)=1
5080   eval_func
5090   PRINT EX
5100   IF EX>MX THEN
5110    MX=EX
5120    GX=I
5130    HX=J
5140   END IF
5150   BX(I,J)=0
5160  END IF
5170  END FOR I
5180 END FOR J
5190 BX(GX,HX)=1
5199 END DEFINE o_move_tree

6000 DEFINE PROCEDURE x_move
6010 INPUT "YOUR MOVE ";IX,JX
6020 AX(IX,JX)=1
6199 END DEFINE x_move

7000 DEFINE PROCEDURE print_board
7010 FOR J=1 TO 3
7020  FOR I=1 TO 3
7030   IF AX(I,J)=1 THEN
7040    PRINT "X";
7050  ELSE
7060   IF BX(I,J)=1 THEN
7070    PRINT "O";
7080  ELSE
7090   PRINT " ";
7100  END IF
7110  END IF
7120  PRINT " ";
7130 END FOR I
7140 PRINT
7150 END FOR J
7999 END DEFINE print_board

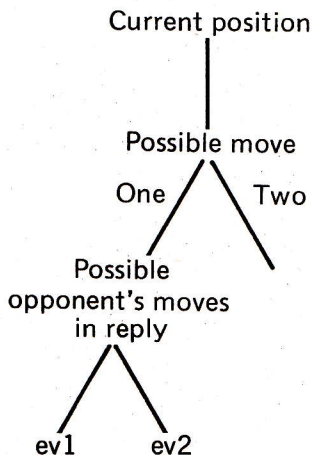
```

consider our opponent's as well is impossible because we cannot either determine or dictate this.

However, if we suppose that our opponent is at all competent it is clear that he will make a move that is 'good' for his position after our move. And this means trying to make our position as bad as possible.

So, if we find a next move that results in the largest value of the evaluation function, we might be disappointed to discover that our opponent's next move considerably reduces its value. Obviously, faced with this situation it makes sense not to play the move that maximises the evaluation function but one that results in the largest evaluation function, *after* our opponent has played his most devastating move. As his most devastating move will be the one that *minimises* our evaluation function, we are in fact playing the move that maximises the evaluation function, after our opponent has tried to minimise it. This strategy is known for obvious reasons as minimax.

The idea of maximising the minimum is not an easy idea to grasp in one go so it is worth going over the details once again but this time by way of an example. A two-ply program not only has to examine every move that it might make, but also every possible reply that its opponent might make. In the case of a non-competitive game the program would be trying to maximise the evaluation function calculation on the position two moves ahead. But in the case of a competitive game, the second move belongs to the opponent and he will make the move that minimises the evaluation function. This situation can be represented by the following diagram, called a 'move tree':



## PROGRAM 2

```

80 t_move_tree

3000 DEFine PROCEDURE t_move_tree
3010 GX=-255
3020 FOR J=1 TO 3
3030 FOR I=1 TO 3
3040 IF AX(I,J)=1 OR BX(I,J)=1 THEN
3050 PRINT "OCCUPIED"
3060 ELSE
3070 BX(I,J)=1
3080 DX=255
3090 FOR M=1 TO 3
3100 FOR N=1 TO 3
3110 IF AX(M,N)=0 AND BX(M,N)=0 THEN
3120 AX(M,N)=1
3130 eval_func
3140 IF EX<DX THEN DX=EX
3150 AX(M,N)=0
3160 END IF
3170 END FOR N
3180 END FOR M
3190 PRINT DX
3200 IF DX>GX THEN
3210 GX=DX
3220 A1X=I
3230 B1X=J
3240 END IF
3260 BX(I,J)=0
3270 END IF
3280 END FOR I
3290 END FOR J
3300 BX(A1X,B1X)=1
3999 END DEFine t_move_tree

4270 EX=256*YX(4)-128*XX(4)-63*XX(3)+31*YX(3)-15*XX(2)+7*YX(2)
4280 FX=128*XX(4)-63*XX(3)+31*XX(3)-15*YX(2)+7*XX(2)
  
```

The real move tree even for noughts and crosses will be much larger than this. In the situation shown, to evaluate "possible move one" the program has to examine each of the possible replies that its opponents could make by working out the resulting evaluation functions, ie, ev1 and ev2. Let us suppose that ev1 works out to be 5 and ev2 10. It's obvious that the opponent will choose the first move in reply (it minimises the program's evaluation function). So, if the program chooses move one, the result will be ev1 (ie, 5) at the next move. In the jargon of computer game playing, ev1 is the 'backed-up' value of the evaluation function (ie, it's an evaluation of the state of the game passed back up the move tree from a lower level) and the program selects the move that maximises the backed-up value.

## Programming Trees

To produce a SuperBasic program that implements this two-ply minimax search it is only necessary to rewrite the search procedure and evaluation function procedure. The new versions of these procedures are presented above.

If you've followed the discussion of the one-ply program and ideas involved in the minimax search, the workings of this program should become clear after a little study. Procedure `t_move_tree` takes each possible move in turn and evaluates it by making each possible reply, then calls procedure `eval_func`

to calculate the evaluation function. The backed-up score is found by storing the minimum result of procedure `eval_func` in `D%`. This is then compared to the current largest value of the backed-up score stored in `G%`. In this way the move that has the largest backed-up score is found. Notice that, as procedure `eval_func` still calculates the evaluation function on the board as it actually stands, it's first of all necessary to make each possible move, call procedure `eval_func` to evaluate it, and then remember to unmake it to restore the board to its original condition. The other important point is including a count of the number of three 'X' lines. In the one-ply program, a line of three 'X's could never be present for the evaluation function to report on because the game would have ended at an earlier move. However, in the two-ply program looking two moves ahead, it's possible for it to foresee such a disaster and so the evaluation function must be modified to reflect the importance of NOT making a move that results in a line of three 'X's at the opponent's next move!

The first thing that should strike you about the two-ply program is its slowness. This is partly due to the fact that for the sake of clarity, no attempt has been made to save time in the BASIC program. However, it is also a reflection of the fact that the amount of work required for a two-ply search is greater. This is at the root of most of the problems encountered in writing game-

playing programs. Even a poor evaluation function will improve when used further down the move tree but the amount of calculation involved grows to astronomical proportions!

## Final Conflict

The game of noughts and crosses is good enough as an example of a two-ply program but simply isn't difficult enough to warrant a deeper evaluation, and hence more programming. To see how to develop these, we will have to consider chess, draughts or a 3D version of noughts and crosses. For a program to play any of these games at all it is necessary for it to examine the move tree to a depth of four or more moves on. To examine the entire move tree to this depth requires many hours (even if written in machine code) so most of the

programming effort goes into finding ways of ignoring moves that are obviously not worth making. This is often referred to as 'pruning'.

Other interesting areas include special methods for playing opening and end games. In the case of noughts and crosses the first move made by '0' is either the top left hand corner or the centre depending on which is unoccupied. This observation can be used to speed up the program by writing a special 'first move' procedure. This is an example of an opening game routine. In the case of chess it is usual to keep the first few moves of 'classical' openings stored in memory to take the game to a point where the evaluation function can take over. In the same way there are often special strategies for ending a game which can also be built into game-playing programs to take over from the evaluation function, when the game has reached a point where it can be easily won.

Programs that play games now do nearly as well as human players and this is one area of intelligent behaviour that we certainly cannot call our own. However, there is still much work to be done. In particular chess players often claim that chess programs lack any sort of personality or style. With this in mind it seems likely that the next breakthrough in computer game playing will come from the study of human characteristics such as aggression!

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# TERMINAL EMULATION

Adam Denning continues this universal terminal software for the QL with some handy embellishments.

Now that we have a rudimentary terminal emulator up and running, we can add various procedures and functions to increase its usefulness and sophistication. The routines shown this month provide all the functions to be shown on menus 1 and 2. This includes Baud rate alteration, local echo status, device to device copying, defaults creation, and so on.

The function which decides which of the five menus to select is called **action** which appeared last month as

a dummy routine. This issue contains the real version of the routine. It is made up simply of a SWITCHON statement to choose between one of six options. A selection is made by pressing one of the five function keys and also includes the 'operator pause' code for when CTRL-S is pressed.

The routines for F3, F4 and F5 are not shown in this issue, but will appear later on. In order to add this part of the code to the main program, you will have to provide dummy routines for **poptions**, **dopipes** and **doexpr** until the finale.

We begin with **dopause()**. This is called whenever CTRL-S is pressed and simply suspends all operations until a CTRL-Q is fed in. Once this is done, the status window is reinstated

and the procedure returns.

A little more complicated, the **options** procedure provides access to the first four functions. To avoid messing up the terminal window, all prompts and messages are made to appear on the command window. The routine waits until either 'B', 'C', 'E', 'O' or 'ESC' is pressed, and then uses a SWITCHON block to determine the action. As there is no CASE for escape, pressing this key effectively aborts the menu.

If 'B' is pressed, a routine is called to collect a new Baud rate from the user and then this is sent to QDOS with the BAUD procedure. 'C' causes the *crlf* global variable to be altered according to the next key pressed, which may be any of '0', '1', '2' or '3'.

## FUNCTIONS

```
// continuation of terminal emulator (C) 1984 Adam Denning
// This is the REAL action function (remember last month's dummy?)
AND action(char) = VALOF SWITCHON char INTO
$(
  CASE ctrl: dopause()
    RESULTIS FALSE
  CASE f1: options()
    RESULTIS FALSE
  CASE f2: RESULTIS options()
  CASE f3: poptions()
    RESULTIS FALSE
  CASE f4: dopipes()
    RESULTIS FALSE
  CASE f5: doexpr()
    RESULTIS FALSE
)
AND options() BE
$( LET option = ?
  SCREEN(screen.nocursor)

  SELECTINPUT(command)
  SELECTOUTPUT(command)

  WRITES("M B: alter baud rate C: CR/LF value E: toggle local echo D: toggle online status")
  option := capsin() REPEATUNTIL option = 'B' ! option = 'C' !
  SWITCHON option INTO
  $(
    CASE 'B': baudrate := get.baud("New baud rate")
      BAUD(baudrate)
    ENDCASE
    CASE 'C': WRITES("M Press 0 for CR = CR, 1 for CR = LF, 2 for CR = CR and LF or 3 for BBC mode")
      crlf := capsin() - '0' REPEATUNTIL 0 <= crlf <= 3
    ENDCASE
    CASE 'E': local := NOT local
    ENDCASE
    CASE 'D': online := NOT online
    ENDCASE
  )
  SCREEN(screen.clear)
  set.com()
  set.status()
  SELECTINPUT(SYSIN)
  SELECTOUTPUT(SYSOUT)
  SCREEN(screen.cursor)
)
AND get.string(string,length,prompt) BE
$( LET count = ?

  WRITEF("NZS:=%",prompt)
  count := READLINE(string,length)
  count := count < 0 -> -count, count - 1
  BACKMVB(string << 2,(string << 2) + 1,count)
  stringZ0 := count
)
AND get.baud(string) = VALOF
```

```
$( LET numvector = VEC 3
  $( LET value = ?
    get.string(numvector,12,string)
    value := get.dec(numvector)
    IF value = 75 ! value = 300 ! value = 600 !
      value = 1200 ! value = 2400 ! value = 4800 !
      value = 9600 THEN RESULTIS value
    WRITES("NInvalid value - press a key")
    RDCH()
  ) REPEAT
)
AND get.dec(decvec) = VALOF
$( LET count = 0
  IF decvecIO < 1 THEN RESULTIS -1

  FOR i = 1 TO decvecIO DO
  $( LET ch = decvec[i]
    TEST '0' <= ch <= '9' THEN ch := ch - '0'
    OR RESULTIS -1
    count := count + 10 + ch
  )
  RESULTIS count
)
AND options() = VALOF
$( LET option,val = ?,?
  SCREEN(screen.nocursor)

  SELECTINPUT(command)
  SELECTOUTPUT(command)

  WRITES("M C: device-to-device copy D: delete file F: create defaults file L: log off")
  option := capsin() REPEATUNTIL option = 'C' ! option = 'D' !
  option = 'F' ! option = 'L' ! option = esc
  val := VALOF SWITCHON option INTO
  $(
    CASE 'C': copydev()
      RESULTIS FALSE
    CASE 'D': $( LET fname = VEC 10
      get.string(fname,42,"Delete")
      DELETE(fname)
    )
      RESULTIS FALSE
    CASE 'F': def.file()
      RESULTIS FALSE
    CASE 'L': SELECTOUTPUT(serial)
      WRCH(Logoff)
      SELECTOUTPUT(command)
      RESULTIS TRUE
    CASE esc: RESULTIS FALSE
  )
  SCREEN(screen.clear)
  set.com()
  SELECTINPUT(SYSIN)
  SELECTOUTPUT(SYSOUT)
  SCREEN(screen.cursor)
  RESULTIS val
)
)
```

'E' and 'O' simply switch logical states and have no effect on the values of their respective global variables.

The routine `get.string()` is used to read in a string from the keyboard and put it into BCPL string format. It uses `BACKMVB` to move all the characters up one byte so we can insert the length into byte 0 of the string in normal BCPL fashion.

Additionally, `get.baud()` collects a value from the keyboard, checks that it is a legal Baud rate, and returns the value as its result. Also fairly standard, `get.dec()` is a routine to convert a string of digits into a decimal number.

The next menu is created by the procedure `moptions`. Here, if 'C' is pressed, a routine called `copydev()` is called, while 'D' causes a filename to be collected and deleted. 'F' is the option to create a new default setup parameter file, and this is collected from the user through the `def.file` routine. If the user wants to log off 'L'

is pressed, so the requisite character is sent, and `moptions` is made to return TRUE. This will be detected higher up and cause the program to end.

The routine `copydev()` collects two file or device names from the keyboard and attempts to open the first for input and the second for output. When two channels have successfully been opened, they are passed as parameters to the `dev2dev` procedure. This does the actual copying, using a buffer collected from the heap using `GETVEC`. Notice how we choose a buffer size equal to one floppy disk (and microdrive) sector. When all the bytes have been sent, both input and output channels are closed and the routine ends. The procedure does *not* copy file headers, so do not attempt to use it to copy files which are to be run as jobs.

Moving on, the routine `def.file()` collects a filename from the keyboard and attempts to open it for output.

When this succeeds, the main body of the routine is entered. Each parameter is gathered up and put into a string called `deftemp`. When complete, the string is written out to a file and the channel is closed.

Notice that in all the routines which collect a filename from the user, the routine can be aborted by just pressing ENTER. This is detected in each routine (as the string length will be 0) and causes each procedure to finish straightaway.

The functions we've added this month, though simple make our emulator considerably more user-friendly. In the next issue we continue along this path, adding a third menu, which allows us to send files down the serial line, read data into files, catalogue disks and microdrives, and have complete control over all the jobs in the machine. Routines will be more involved, as the interface between the BCPL and QDOS is stretched almost as far as it can go.

```

option := capsin() REPEATUNTIL option = 'M' | option = 'S' | option = 'O' |
option = 'E' | option = 'N'
deftemp22 := option
WRITES("Default RTS/CTS handshaking (Y/N): ")
option := capsin() REPEATUNTIL option = 'Y' | option = 'N'
deftemp23 := option
WRITES("Default data protocol (R/Z/C): ")
option := capsin() REPEATUNTIL option = 'R' | option = 'Z' | option = 'C'
deftemp24 := option
option := get.baud("Default baud rate")
deftemp25 := VALOF SWITCHON option INTO
CASE 75:   RESULTIS '1'
CASE 300:  RESULTIS '2'
CASE 600:  RESULTIS '3'
CASE 1200: RESULTIS '4'
CASE 2400: RESULTIS '5'
CASE 4800: RESULTIS '6'
CASE 9600: RESULTIS '7'
$)
WRITES("Default local echo status (0/1): ")
option := RDCH() REPEATUNTIL option = '0' | option = '1'
deftemp26 := option
WRITES("Default online status (0/1): ")
option := RDCH() REPEATUNTIL option = '0' | option = '1'
deftemp27 := option
WRITES("Default CR/LF value (0/1/2/3): ")
option := RDCH() REPEATUNTIL option = '0' | option = '1' | option = '2' |
option = '3'
deftemp28 := option
LET numvector = VEC 3
$( get.string(numvector,12,"Default log off character (0 - 255)")
option := get.dec(numvector)
IF 0 < option <= 255 THEN BREAK
WRITES("Invalid value - press a key")
RDCH()
$) REPEAT
$)
deftemp29 := option
SELECTOUTPUT(stream)
WRITES(deftemp)
ENDWRITE()
SELECTOUTPUT(command)
$)
AND dopause() BE
$( LET a,inf,outf = ?,INPUT(),OUTPUT()
SELECTOUTPUT(status)
SELECTINPUT(SYSIN)
WRITES("N OPERATOR PAUSE - PRESS CTRL-Q TO RESUME")
a := RDCH() REPEATUNTIL a = ctrlq
set.status()
SELECTOUTPUT(outf)
SELECTINPUT(inf)
$)

```

```

AND copydev() BE
$( LET dev1,dev2 = ?,?
LET fname1 = VEC 10
LET fname2 = VEC 10
$( get.string(fname1,42,"Copy from")
IF fname10 = 0 THEN RETURN
dev1 := FINDINPUT(fname1)
IF dev1 < 0 THEN $( WRITEL("Cannot open %S - press a key",fname1)
RDCH()
$)
$) REPEATWHILE dev1 < 0
$( get.string(fname2,42,"Copy to")
dev2 := FINDOUTPUT(fname2)
IF dev2 < 0 THEN $( WRITEL("Cannot open %S - press a key",fname2)
RDCH()
$)
$) REPEATWHILE dev2 < 0
WRITEL("Copying %S to %S...",fname1,fname2)
dev2dev(dev1,dev2)
$)
AND dev2dev(stream1,stream2) BE
$( LET transbuf,bytes = ?,?
transbuf := GETVEC(127)
IF transbuf = 0 THEN $( WRITEL("No room for buffer! - press a key")
RDCH()
CLOSE(stream1)
CLOSE(stream2)
RETURN
$)
SELECTINPUT(stream1)
SELECTOUTPUT(stream2)
$( bytes := READBYTES(transbuf,512)
WRITEBYTES(transbuf,bytes)
$) REPEATWHILE bytes = 512
ENDREAD()
ENDWRITE()
SELECTINPUT(command)
SELECTOUTPUT(command)
FREEVEC(transbuf)
$)
AND def.file() BE
$( LET stream,option = ?,?
LET fname = VEC 10
LET deftemp = VEC 2
deftemp20 := 9
$( get.string(fname,42,"Write default setup parameters into")
IF fname10 = 0 THEN RETURN
stream := FINDOUTPUT(fname)
IF stream < 0 THEN $( WRITEL("Cannot open %S - press a key",fname)
RDCH()
$)
$) REPEATWHILE stream < 0
WRITES("Default port (1/2): ")
option := RDCH() REPEATUNTIL option = '1' | option = '2'
deftemp21 := option
WRITES("Default parity (N/S/O/E/W): ")

```



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# GRAPHICS

Ian Stewart begins a new series for beginners, on QL graphics and and screen handling.

Quite apart from its power and versatility, the QL has an artistic side too – some of the best graphics facilities yet to grace domestic TV screen or monitor. With it you can create everything from pictograms to Picassos, from garish toothpaste ads to lullaby landscapes. Here we start from square one and introduce some basic techniques in computer graphics, taking full advantage of the QL's structured SuperBasic, which facilitates programming chunk by chunk and then we hook the chunks together. This makes for easy debugging and endless experimentation.

The main building blocks for graphics are points, lines, circles, and rectangles, together with commands that set colours, fill in solid areas, and select the most suitable graphics mode.

The QL can work with either a TV or a monitor, and certain program details change from one to the other. To keep everything simple let's assume you're using a TV. So, when you switch on, press key F2 – even if you're using a monitor.

If you've been using the QL for some other purpose, it may be in a non-standard state. Either reset it (removing microdrive cartridge first) or enter (as necessary) the commands FILL 0: OVER 1: MODE 8: SCALE 100,0,0. If you haven't changed any of these, there's no need to bother; but if you have, you can get bizarre results from a perfectly reasonable program, and it can be a trifle confusing.

## POINT TO POINT

Assuming you've done that, the QL's screen display can be thought of as consisting of 101 rows of tiny square cells, each row being 166 cells long. The rows are numbered 0-100 from bottom to top; the columns 0-165 from left to right. Points on the screen are referred to by their coordinates, so a point with coordinates (28,43)

lies in column 28 of row 43. The command POINT x,y plots a single cell, in the current INK colour, at position (x,y). Here's a program that plots out a fuzzy, multicoloured ring.

```
100 PAPER 0:CLS
110 REPEAT loop
120   x=RND(20,80):y=RND(20,80)
130   dist=(x-50)*(x-50)
      +(y-50)*(y-50)
140   IF dist<900 AND
      dist>350 THEN
150     INK dist/100-2
160     POINT x,y
170   END IF
180 END REPEAT loop
```

Here the variable *dist* (the square of the distance from the centre (50,50)) is used to make sure that only a ring-shaped region is plotted. The points are colour-coded according to distance in line 150. Press CTRL/SPACE to break the program when you're satisfied.

The command LINE a,b TO c,d joins the points (a,b) and (c,d) together by a straight line. Suppose you take a circle, and join every point on it to the point at twice the angle (starting conventionally at 3 o'clock as angle zero and working anticlockwise). What do you get? Try this:

```
100 PAPER 1:INK 7:CLS
110 k=2
120 FOR angle = 0 TO 360 STEP 3
130   a=RAD(angle)
140   x1=80+50*COS(a)
150   y1=50+50*SIN(a)
160   x2=80+50*COS(k*a)
170   y2=50+50*SIN(k*a)
180   LINE x1,y1 TO x2,y2
190 END FOR angle
```

As you will see the result is dramatic: the lines surround a curve, known as a *cardioid* because it is heart-shaped. What happens if we treble the angle or quadruple it? Change line 110 to:

```
110 INPUT#0,"Multiple
to be used"!k
```

(The #0 gets the message into the lower section of screen, out of harm's way, and ! is an intelligent space.) Input your choice of 3, 4, 5, ... for k,

and see what happens. For  $k = 3$  you get a curve with two sharp corners (*cusps*) called the *Nephroid* because it's shaped like a kidney. The anatomical terminology stops there – the remaining curves come under the name of *epicycloids*.

The command CIRCLE x,y,r draws a circle with centre (x,y) and radius r. Here's a fancy design made entirely out of circles:

```
100 PAPER 0:CLS
110 FOR t=-120 TO 120 STEP 4
120   x=80+t:y=50+t/2:
      r=t*t/150+10
130   CIRCLE x,y,r
140 END FOR t
```

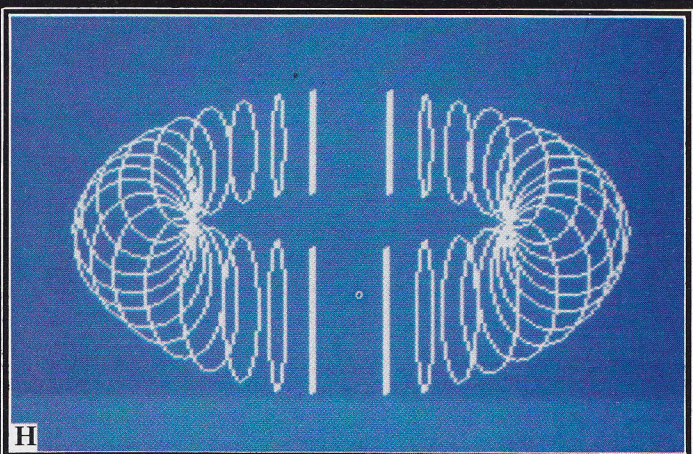
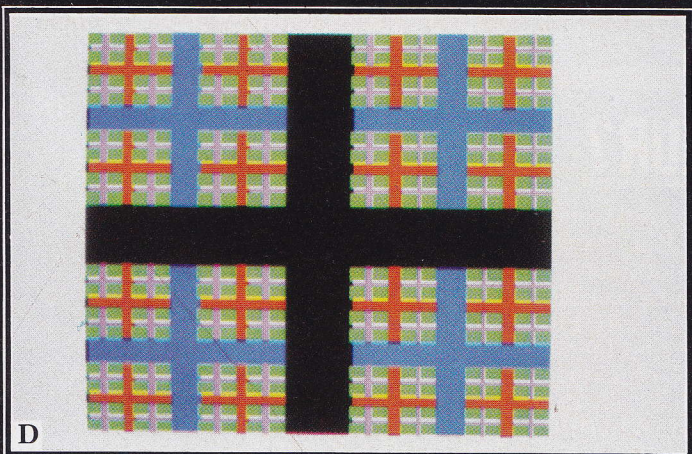
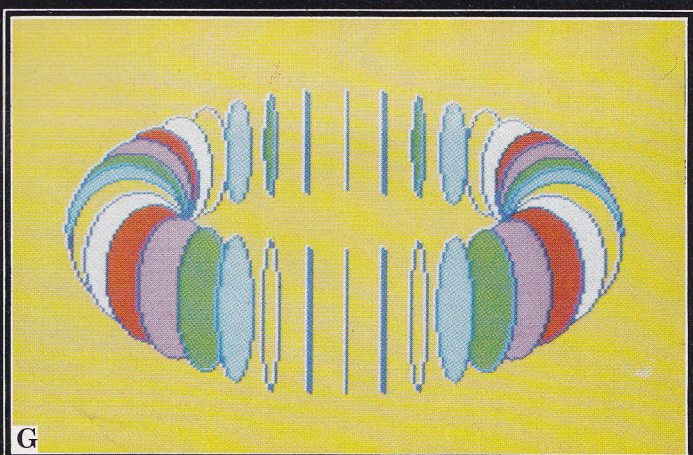
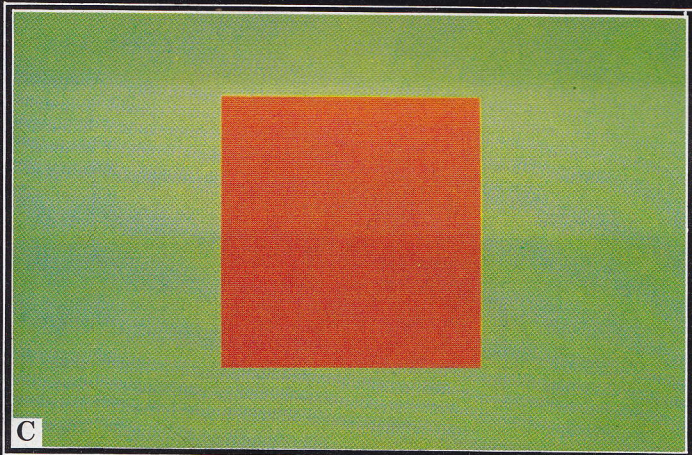
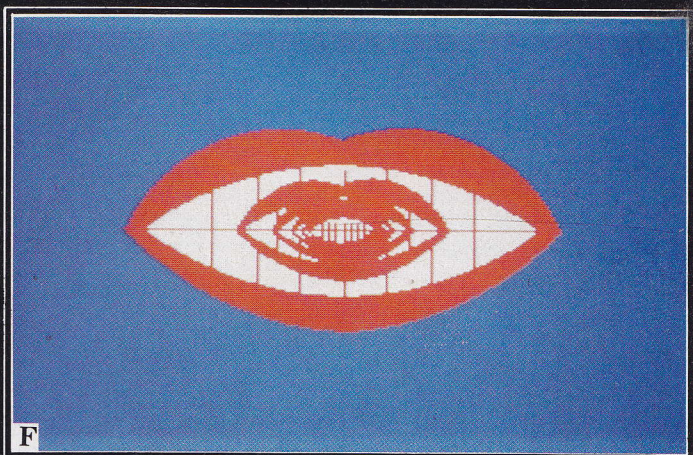
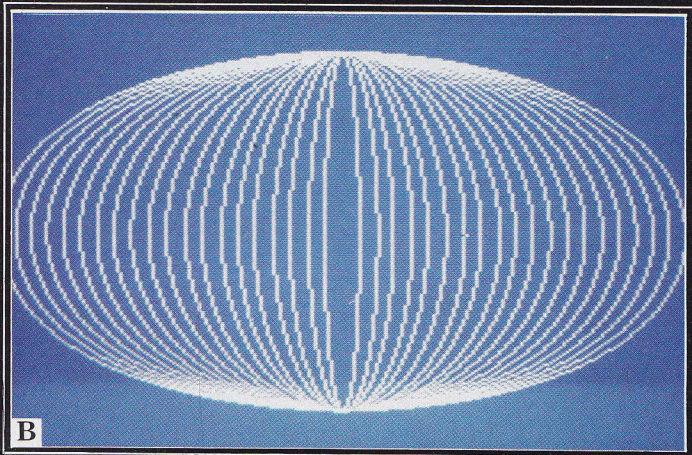
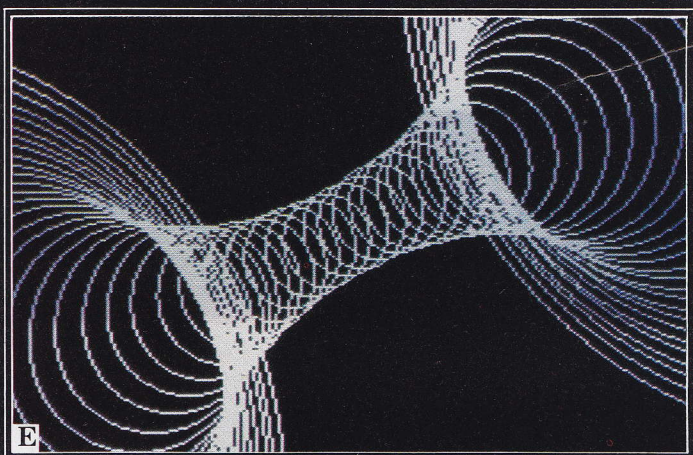
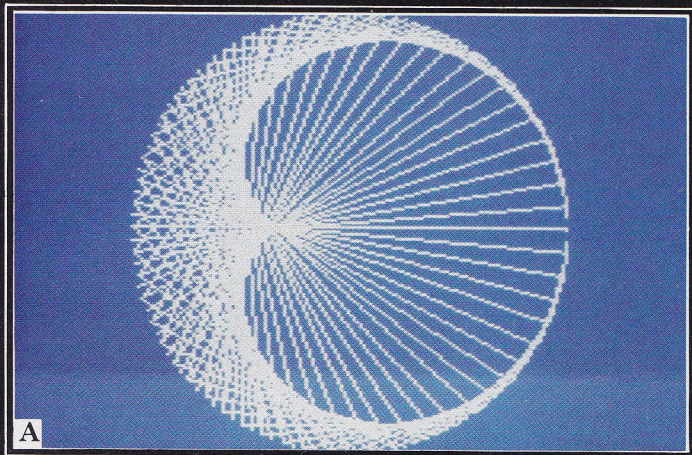
If you run this, you will see the circles shrink and grow. It's like looking into the end of a tube that narrows down and then widens out again, while bending into a U shape.

An ellipse is a flattened circle. And by adding further parameters to the CIRCLE command, you can draw these. In fact you can replace the keyword CIRCLE by ELLIPSE for clarity. The syntax is ELLIPSE x, y, r, ecc, ang where (x, y) is the centre, r the radius, ecc, how flattened the ellipse is (the *eccentricity*, or ratio of width to height), and ang is the angle (in radians) to which it is tilted.

```
100 PAPER 1:INK 7:CLS
110 FOR ecc=0 TO 2 STEP .1
120   ELLIPSE 80,50,40,ecc,0
130 END FOR ecc
140 PAUSE:CLS
150 FOR a=0 TO 180 STEP 10
160   ang=RAD(a)
170   ELLIPSE 80,50,15,3,ang
180 END FOR a
```

With a little more effort we can draw sections of a torus (like a doughnut with a hole in the middle):

```
100 PAPER 1:INK 7:CLS
110 FOR a=0 TO 360 STEP 10
120   t=RAD(a)
130   x=80+50*COS(t)
140   y=50+20*SIN(t)
150   r=20-y/8
160   ecc = COS(t)*COS(t)
170   ELLIPSE x,y,r,ecc,0
180 END FOR a
```



## FILL IT UP

The FILL command lets you shade in any *closed convex* curve with the current INK colour. You turn it on with FILL 1 and off again with FILL 0. For instance, to draw a solid red square, you turn it on, draw the outline and turn it off again. Like this:

```
100 PAPER 4:INK 2:CLS
110 FILL 1
120 LINE 50,20 TO 110,20
    TO 110,80 TO 50,80 TO 50,
20
130 FILL 0
```

If you don't switch FILL off at the end of each item, the computer will stay in FILL mode and anything else drawn will look a little different from what you intended. It can be used in conjunction with CIRCLE, ELLIPSE, and other graphic commands. The next program exploits this to make our doughnut look three-dimensional.

```
100 PAPER 6:INK 7:CLS
110 FOR a=0 TO 180 STEP 10
120   cr%=a/10
130   IF a=0 THEN INK
    1: LINE 80,59 TO 80,82
140   FOR s=-1 TO 1 STEP 2
150     INK cr% MOD 6 + 2
160     t=RAD(a*s+90)
170     x=80+50*COS(t)
180     y=50+20*SIN(t)
190     r=20-y/8
200     ecc = COS(t)*COS(t)
210     FILL 1
220     ELLIPSE x,y,r,ecc,0
230     FILL 0
240     INK 1
250     ELLIPSE x,y,r,ecc,0
260   END FOR s
270   IF a=180 THEN INK
    1:LINE 80,14 TO 80,46
280 END FOR a
```

Line 250 puts a blue border on each ellipse for clarity; and lines 130 and 270 deal with a feature (irremovable bug) in ELLIPSE, which can't handle eccentricity zero.

An arc is a piece of a circle and the command ARC x1, y1 TO x2, y2, ang will draw an arc from (x1, y1) to (x2, y2) which yields an angle *ang* at the circle's centre. The angle is measured anticlockwise, from start to end of the arc, in radians.

Here's a program using ARC that was written as an advertisement for the Popsident Toothpaste Conglomerate.

```
100 PAPER 1:INK 2:CLS
110 FILL 1
120 ARC 30,50 TO 80,70,-1.5
    TO 80,28,-.3 TO 30,50,-.75
130 FILL 0
140 FILL 1
150 ARC 130,50 TO 80,70,1.5
    TO 80,28,.3 TO 130,50,-.75
160 FILL 0
170 FILL 1:INK 7
180 ARC 35,50 TO 125,50,1.2
    TO 35,50,1.2
190 FILL 0:INK 2
200 LINE 35,50 TO 125,50
210 FOR k=50 TO 110 STEP 10
220   LINE k,36 TO k,64
230 END FOR k
```

The screen area is treated like a transparent 'doorway' into the (x, y) plane. (This can't be called a *window*, because the QL uses that for a related but different idea.) The standard 'default' position of this doorway is 0-100 in the x-direction, 0-165 in the y-direction. The SCALE command lets the doorway be moved around, staying the same shape, but varying in size and position. In fact SCALE vh, x0, y0 creates a doorway with vertical height vh (and width about 1.65\*vh), and bottom left corner at (x0, y0). To elaborate that toothpaste ad, add the lines shaded:

```
100 PAPER 1:INK 2:CLS
102 FOR vh=100 TO 600 STEP 100
104   SCALE vh,80-.8*vh,50-.5*vh
110 FILL 1
120 ARC 30,50 TO 80,70,-1.5
    TO 80,28,-.3 TO 30,50,-.75
130 FILL 0
140 FILL 1
150 ARC 130,50 TO 80,70,1.5
    TO 80,28,.3 TO 130,50,-.75
160 FILL 0
170 FILL 1:INK 7
180 ARC 35,50 TO 125,50,1.2
    TO 35,50,1.2
190 FILL 0:INK 2
200 LINE 35,50 TO 125,50
210 FOR k=50 TO 110 STEP 10
220   LINE k,36 TO k,64
230 END FOR k
240 END FOR vh
```

## EN COULEUR?

All those overlapping red mouths tend to look jumbled. But we could draw them in different colours. Or, being lazy, the colours could be *changed* after they're drawn. (Picaso could have gone from his blue to his pink period at the touch of a button.) The command RECOL c0, c1, c2, c3, c4, c5, c6, c7 changes colour 0 to c0, 1 to

c1, and so on. Here c0-c7 are colour codes in the range 0-7. Here it is in the toothpaste ad.

The new lines are shaded:

```
100 PAPER 1:INK 2:CLS
102 FOR vh=100 TO 600 STEP 100
104   SCALE vh,80-.8*vh,50-.5*vh
110 FILL 1
120 ARC 30,50 TO 80,70,-1.5
    TO 80,28,-.3 TO 30,50,-.75
130 FILL 0
140 FILL 1
150 ARC 130,50 TO 80,70,1.5
    TO 80,28,.3 TO 130,50,-.75
160 FILL 0
170 FILL 1:INK 7
180 ARC 35,50 TO 125,50,1.2
    TO 35,50,1.2
190 FILL 0:INK 2
200 LINE 35,50 TO 125,50
210 FOR k=50 TO 110 STEP 10
220   LINE k,36 TO k,64
230 END FOR k
232 c=vh/100
234 IF c<3 THEN c=c-1
236 RECOL 0,1,c,3,4,5,6,7
240 END FOR vh
250 REPEAT loop
260 RECOL 7,6,5,4,3,2,1,c
270 END REPEAT loop
```

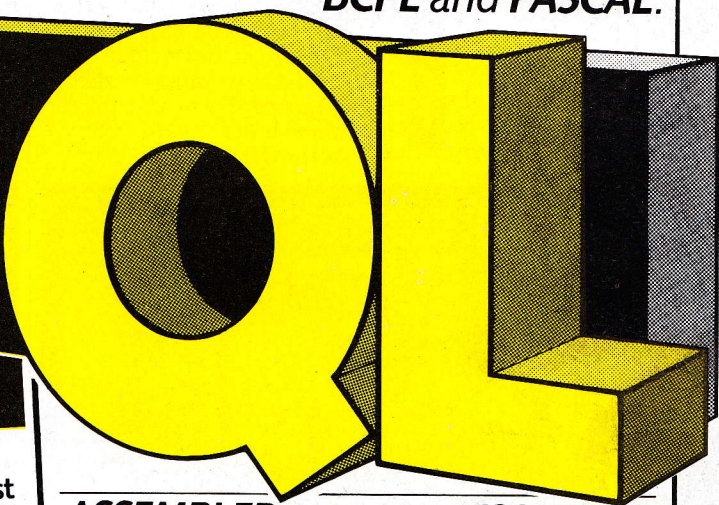
There is a different coordinate system, used by some of the graphics commands (BLOCK, WINDOW for example). It has 256 rows (0-255) and 512 columns (0-511), but on a TV display these are effectively cut down to 200 rows (0-199) and 450 columns (0-449). The rows now run from top to bottom. In pixel graphics, a solid rectangle of colour can be produced using:

BLOCK w, h, x, y, c  
where w is the width, h the height, (x, y) the coordinates of the top left corner, and c the colour code. As a final fling, here's a design of a tartan for the McFractal clan: It uses a technique called *recursion*, whereby a procedure in SuperBasic can be made to call itself, like a snake eating its own tail. We'll go into this idea later in the series.

```
100 PAPER 7:CLS
110 box 100,10,180,0
120 STOP
1000 DEFINE PROCEDURE box(x,y,s,n)
1010   LOCAL a,b,x0,y0,s0
1020   IF n=5 THEN END DEFINE box
1030   BLOCK 1.6*s,s,x,y,n
1040   FOR a=0 TO 1
1050     FOR b=0 TO 1
1060       x0=x+a*.4*s/7
1070       y0=y+b*.4*s/7
1080       s0=3*s/7
1090       box x0,y0,s0,n+1
1100     END FOR b
1110   END FOR a
1120 END DEFINE box
```

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QL6

# THE PROGS

A slight diversion this month, as we look at some interesting graphics screens from our recent competition and announce the winners (Part II next month).

## Talent Spotters - I

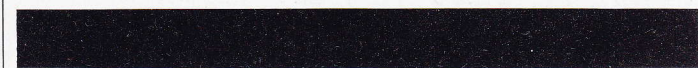
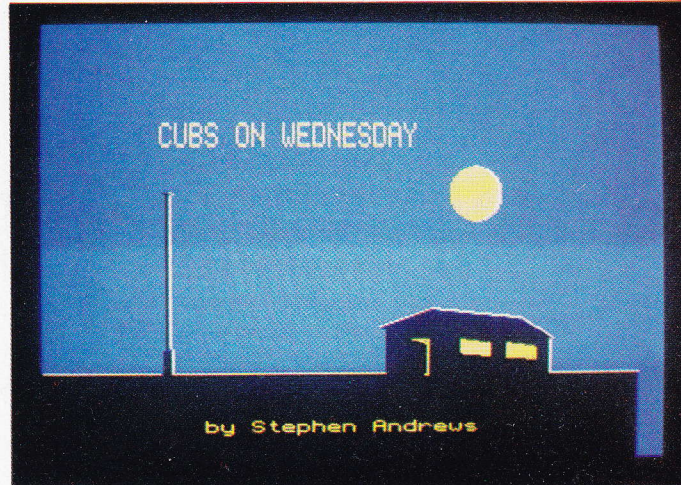
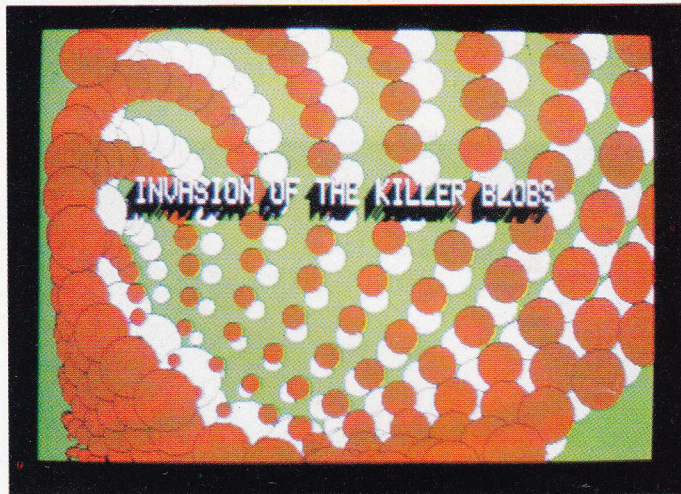
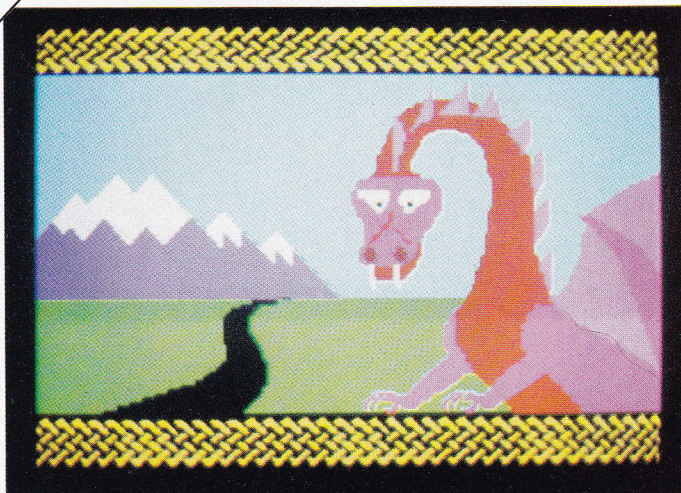
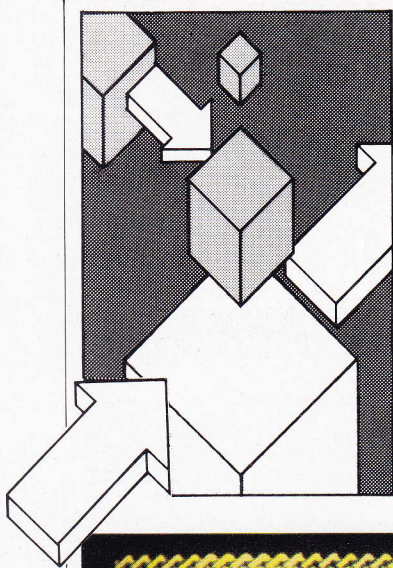
The quality of the entries for our Talent Spot competition (March) was so high that we have forgone our usual format for the 'progs' and include instead the winning entries. Five appear this month and the remainder next month.

As the QL has a

comprehensive set of graphics commands the competition might not have seemed difficult. However, with only 25 lines code, with a maximum of 50 characters to each line, the prospect becomes daunting.

The winning entries came from: Andrew Arnold

(Southport), A Pritchard (Addlestone), Stephen Andrews (Chippenham), Hugh McGovern (Horwich), J Whitton (North Halling), Nick Flowers (Hailsham), Richard Belsey (Hitchin), M Picknell (Balsall Common) and last, with two entries Chris Bower (Wokingham).



## Dragon's Portrait

Chris Bower

This was the most sophisticated entry we received. Its author has ingeniously circumvented the

length restriction. The code has been condensed using an encryption routine linked to the QL's alternative char-set.

The picture takes some five

```
101 a$="!jAÉSpu+r;φ)1φ#;π30u&KK $Ar $B $&i00 P2i(0q6"
102 DATA a$%"23X% (c[§A2!g&kx*db+H+r+SA+",",+,"+"
103 DATA "<,<","4,4","!i00 0N0 00r !hæè"
104 DATA "!n8+a+3+10+10Ae*0+9 A1c","!fyé+1 R01+ A9"&b%
105 b$="+ AI+ S1;1+C1+'+1A+1+1y+139Y39S1(1;131+&A00"
106 DATA "A000&q00P0&k8","1+;é1+ I+01i+1 /+1 310"
107 DATA "0+1 031 00s01+ ","3++59015+3+33µ2µX*"
```

# THE PROGS

```

108 DATA "é3 -9=", "q/+1319=", "i?Y+17", "31I+17i+1/"
109 DATA "pés!f!m!gkA00i0z_2!nbs", "309+7Y+11"
110 DATA "lé1+ A30K3S;1+4é+ 119+i+19+1", "Q53131=+1+1A"
111 DATA "m+131I", "J+90+1 &A+.", "1++1+1+-(+A+/"
112 c%="1Qé31 Aq1A+C9+1A+110909!spj!r9!d0&^032!f!C&J!t"
113 DATA c%&"2(\23+!sSRS"q0!ux", "S++1,39++,"
114 DATA "\,1;+1+=", "0, ", "+1M+K6", "E+;", "C+ "
115 DATA "001H", d%, "AX0 ", "HGepp", "EG"
116 d%="(A!C 00SaaB!kp8<µJµA<<µ D8µA<<µ XTmDmPY!di"
117 DATA "31;::é1+ 1Q+1Y0B'013 1+9+;;109+131"
118 DIM x$(99,99):FOR i=0TO 34:READ z$:x$(i)=z%&" "
119 MODE 8:OPEN#1,scr_512x256a0x0:CLS:t=0:d 0,0:PAUSE
120 DEFINE PROCEDURE d(x,a):LOCAL i,b,e
121 a=a+1:c=CODE(x$(x,a))-34:e=(t+c)MOD 2:SELECT ON c
122 =-2:RETURN :=128TO 141:b=a:FOR i=127TO c:a=b:d x,a
123 =1TO 127:MOVE INT(c/8)*SQRT(1+t):TURN c*45:t=e:=-1
124 a=a+1:INK CODE(x$(x,a))+92:=1TO 156:PENDOWN:FILL 1
125 d x+c-141,0:PENUP:END SELECT :GO TO 121
126 REMARK **** QL User 1985 ****
127 REMARK **** Dragon's Portrait by Chris Bower

```

## Killer Blobs

Edward J Whitton

Geometry comes to the fore in this program. Using a formula carefully worked out to fit the QL's display (line 35) a series of

ever expanding circles are spiralled up across the screen. The overall effect is to create a sense of perspective as well as motion. The joke title also went down a treat.

```

5 REMARK **** QL User 1985 ****
10 REMARK **** Killer Blobs by Edward J Whitton
15 MODE 0:WINDOW #1,512,256,0,0
20 PAPER #1,4:CLS #1:SCALE 400,-50,0:c=2
25 FOR x=100 TO 80 STEP -20
30 c=(2*(c=7))+(7*(c=2)):FOR n=1 TO 300 STEP 1.1
35 a=n*n*SIN(n/5.9*PI):b=n*n*COS(n/5.9*PI)
40 INK c:FILL 1:CIRCLE a-(100-x),b-(100-x),n/10
45 INK 0:FILL 0:CIRCLE a-(100-x),b-(100-x),n/10
50 NEXT n:NEXT x:FOR n=0 TO 10
55 CSIZE 2,1:OVER 1:INK (n<10)+(7*(n=10))
60 CURSOR n+70,100-n
65 PRINT "INVASION OF THE KILLER BLOBS"
70 NEXT n:PAUSE

```

## Cubs

Stephen Andrews

Picture Composition comes before programming skill in this entry. The scene though simple has a bleak eerie

stillness that is quite unique. Furthermore, the simple expedient of surrounding objects with a yellow border captures a moonlight atmosphere.

```

13 REMARK *** QL User 1985 ***
21 REMARK *** Cubs by Stephen Andrews ***
51 DEFINE PROCEDURE QLU
52 WINDOW 512,256,0,0:PAPER 1:INK 0:CLS:FILL 1
53 LINE 29.5,20 TO 29.5,25 TO 31.25 TO 31.25 TO 31.20
54 LINE 30,20 TO 30,60:LINE 29.7,60 TO 31.8,60
55 LINE 31,60.5 TO 30.8,59.5 TO 30.8,25
56 LINE 30.8,25 TO 31.2,25 TO 31.2,20:FILL 0
57 FILL 1: LINE 140,20 TO 140,0 TO 0,0 TO 0,20
58 LINE 0,20 TO 140,20:FILL 0:FILL 1
59 LINE 80,20 TO 80,30 TO 79,30 TO 90,34
60 LINE 90,34 TO 110,32 TO 118,28 TO 117,28
61 LINE 117,28 TO 117,20 TO 80,20:FILL 0
62 INK 6:FILL 1: CIRCLE 100,60,6:FILL 0
63 LINE 0,20.5 TO 29,20.5:LINE 31,60.5 TO 32,60
64 LINE 31,59.5 TO 31,26:LINE 31.5,26 TO 31.5,20.5
65 LINE 31.5,20.5 TO 80,20.5:LINE 78,31 TO 90,35
66 LINE 90,35 TO 110,33 TO 118,28:CSIZE 2,1

```

```

67 LINE 117,20.5 TO 140,20.5:LINE 117,28 TO 117,20
68 AT 3,8:PRINT"CUBS ON WEDNESDAY":PAPER 0
69 CSIZE 2,0:AT 23,11:PRINT "by Stephen Andrews"
70 LINE 89,27 TO 86,28 TO 89,28 TO 89,20 TO 88,20
71 FILL 1:LINE 97,25 TO 97,28 TO 104,27
72 LINE 104,27 TO 104,24.5 TO 97,25: FILL 0
73 FILL 1:LINE 107,24 TO 107,27 TO 114,26
74 LINE 114,26 TO 114,23.5 TO 107,24: FILL 0
75 PAUSE:CLS:END DEFINE

```

## Castle Of Doom

Andrew Arnold

Few superbasic graphics commands appear to have been overlooked in this entry. Randomly generated stars and

forests combine together in a picture that tells a story. The author has crammed as much in as possible even going so far as to include sound (not that we took it into account!)

```

1 MODE 8:PAPER 65:INK 6:CLS:FILL 1:x=0:b=24:OVER 1
2 ARC 10,80TO 22,92,PI TO 10,80,-PI/4:FILL 0:e=274
3 CSIZE 3,1:FOR n=1 TO 100:POINT RND*200,RND*50+50
4 DEFINE PROCEDURE f(ma,o,p,q,c): BLOCK ma,o,p,q,c
5 END DEFINE :INK 0:FILL 1:LINE 0,-1 TO 0,60:w=140
6 FOR n=1 TO 34:LINE_R TO 5,RND(3)*((n<17)-(n>17))
7 t=20:LINE TO 170,-1:INK 4:a=40:y=90:d=85:FILL 1
8 GO SUB b:INK 2:LINE_R -65,68 TO 3,5 TO 3,-5:i=30
9 FILL 1:LINE_R 23.4,0 TO 3,5 TO 3,-5:CSIZE #0,1,1
10 INK 1:CIRCLE 123,43,25,.2,1.6:f 80,d,290,80,240
11 CIRCLE 90,20,25,.21,PI/2:CIRCLE 80,26,t,.21,1.6
12 f 18,t,362,65,240:f 6,6,368,72,0:f 6,6,305,94,0
13 f 18,t,283,65,240:f 6,6,289,72,0:f 6,6,350,95,0
14 FOR n=304 TO 360 STEP 10:f 5,5,n,80,0:INK 3,6,3
15 FILL 1:LINE 130,0TO 120,42,150,0TO 125,42:INK 1
16 FILL 1:LINE_R 4.5,-37TO 4,9TO 4,-9,-9.5,5TO 6,2
17 LINE_R TO 5.5,-2:INK 7:f s,s,320,95,208:AT 8,22
18 PRINT CHR$(183):PRINT#0," Castle Of Doom"
: FILL 0
19 LINE_R -32,61TO 0,6,i,-.5TO 0,-6:INK 4:GO SUB b
20 INK 0:h=-1.5:ARC_R -123,9TO 5,0,h TO 5,0,h:r=-i
21 ARC_R 5,8TO 5,0,h TO 5,0,h,r,8TO 5,0,h TO 5,0,h
22 FOR n=1 TO 6:BEEP 20,n:RECOL #0,0,n,n,n,n,n,n,n
23 ARC 5,9TO 10,90,h TO 15,90,h:BEEP y,n:GO TO 22
24 FOR n=0TO a:CURSOR RND*w*x,RND*d+y:PRINT'>':a=t
25 f 15,6,e,46,90:e=354:s=20:d=35:y=70:x=99:RETURN

```

```

27 REMARK **** QL User 1985 ****
28 REMARK **** Castle of Doom by Andrew R. Arnold
29 REMARK NB. Line 18 amended by our Technical Editor so that no problems are encountered when typin g-in the listing (original line < 50 chars)

```

## Tree

A Pritchard

A stunning surreal landscape. The perspective is breathtaking and the detail

remarkable. The author shows mastery on all fronts. As programming goes, adroit use of recursion enables the tree to be built up branch by branch.

```

100 REMARK *** QL User 1985 ***
110 REMARK *** Tree by A.Pritchard ***
120 PAPER 5:PAPER#2,5:WINDOW 512,256,0,0:MODE 8
130 INK 7:FILL 1:CIRCLE 80,60,10:FILL 0:INK#2,0
140 FOR i=1TO 10:CIRCLE 80,2,i,.1,PI/2:NEXT i
150 FOR h=25 TO 12STEP -1:d:NEXT h:INK 0:FILL 1
160 LINE 0,-3TO 28,40TO 36,40:ARC TO 50,-3,PI/2
170 FILL 0:tr 28,40,20,8:INK 3:AT 0,5:OVER 1
180 CSIZE 3,1:PRINT "Shivering in the Wind";
190 CSIZE 2,0:PRINT "AP85";
200 DEFINE PROCEDURE tr(x,y,l,b):LOCAL i,f,g,b1
210 IF l<2 THEN RETURN
220 FOR i=1TO 4
230 b1=b/2:IF b/2>1 THEN FILL 1
240 f=x+(i*1-1.2*1-RND(1))*1.2:g=y+RND(1)*2.3)-1/3
250 k=0:IF i=4AND l=20 THEN k=3
260 LINE x,y TO f,g TO f+b1-1,g
270 LINE TO x+b-1,y-k TO x,y
280 FILL 0:tr f,g,l/2,b/2:NEXT i:END DEFINE
290 DEFINE PROCEDURE d:p=RND(150)-30:g=RND(160)
300 INK 3:FILL 1:LINE p,10 TO (p+g)/2,h TO g,10
310 FILL 0:INK 7:LINE (p+g)/2,h TO g,10:INK 3,5
320 FILL 1:LINE p,10TO (p+g)/2,10-(h-10)/3TO g,10
330 FILL 0:END DEFINE

```

# NEWS BACKGROUND

## The stories behind the news and background to current topics of interest, from QL User's doyen of discriminating delvers — Sid Smith.

"America is a very tough proposition for any British company," Nigel Searle told us. "People visit New York and California and imagine that the US is like England; if they looked at New Mexico and Nebraska they'd realise it certainly isn't."

Searle was speaking on his last day as Sinclair's Managing Director, and the eve of his move to Boston, Massachusetts, where he'll be leading the company's renewed attempt to sell into the American market.

With eight years' experience in the States, three of them as head of Sinclair US (and with an American wife) Searle is highly qualified for what he sees as "an important strategic move."

"I think some companies go to the States just because they've proved they can play in the boy's game, and want to prove they can play in the men's game. But if Sinclair had had no experience in the States, I'd like to think we'd be taking a very cautious approach indeed.

"However, we sold nearly a quarter of a million of our computers in the States between 1980 and '82, before we did the deal where Timex took over our sales there; so I think we have grounds for being very optimistic."

And was Searle worried about the Atari ST, and its effect on US sales of the QL?

"There are two considerations — will Atari bring that product to the market quickly, and if it does, will it go for distribution primarily in the USA or in Europe?"

"There's evidence that Jack Tramiel thinks European markets are more price sensitive and therefore a more logical place to go with a low-price product. He's also got some reasonably good people in European marketing operations.

"But the bottom line is that I just don't know. So my objective is to establish the QL in America before anyone even sees an ST."

But if Tramiel's machine does appear on time and on

spec, how will the QL fare?

"It's a marketing problem — and the two of us will be taking a very different approach. If Tramiel chooses to launch in the States in the near future at the price he's talked about, then he's going to be wanting very high volume sales — and I don't know if there are that many people who want that much computing power.

"In sheer numbers, we could be successful with much lower numbers than Atari. We'll have a very low overhead operation, and of course the company doesn't stand or fall by how we do in America.

"So our objectives are conservative — to make sure that whatever we sell in the US is sold at a profit. We don't have to die in the attempt to get a major share of that market.

"And software will be developed anyway — not because we're selling 50,000 machines in the USA, for which you wouldn't get any software at all, but because we're selling 500,000 worldwide.

"We have a big commitment to the US market; the very fact that *I'm* going shows that. But

we don't have to take the very big gamble that someone like Jack Tramiel will. He'll have to put in literally \$50m in advertising and production if he's to succeed against Apple and IBM; he'll either make a killing or lose that \$50m."

Your reporter suggested that the hardest part of selling the QL in the US would be selling the microdrive — and got instant agreement from Searle.

"A tough proposition! Particularly because a number of companies like Texas Instruments, and Coleco with the Adam, have released products with high speed tape devices and then not done particularly well.

"Explanations won't help; you've got to *show* people. So part of our job in the US will be getting the machine reviewed by people who really matter, exhibiting at small computer shows and clubs very widely over the country, and having the machine used by a very small group of extremely influential people.

"In Britain, people who write about computing tend to express their own opinions. In

the US, computer journalists always call on some industry guru and quote him or her.

There are no more than seven or eight of these gurus, whether they're from Computer Letter or the Yankee Group or whatever, and Sinclair has to get these people saying, *'this cup's half full'*, rather than, *'this cup's half empty'*.

"I know most of those people from when I was in the States before, and we have to persuade them to sit down with a QL and experience the loading time of something like the spreadsheet program, and to actually pick up a cartridge and put it in their pocket with their keys and coins and see that it is an attractive medium.

"We've got to avoid those people saying, *'here comes another small British company, it got knocked out last time with Timex-Sinclair and it's coming in with a tape-based machine and everyone knows tape is dead as a storage medium'*.

"The way to stop them writing that is to let them experience that the QL is a viable product."

## USER GROUP NEWS

### Leon Heller reports on the latest activities from the independent users' group files.

A one-day workshop was held in Cambridge at the end of April with over 70 people attending.

Tony (QDOS) Tebby was much in demand, answering questions on QL hardware and software, and GST were showing off the production version of their C compiler, launched at our earlier Swindon meeting. A couple of mice put in an appearance, interfaced to QLs, with some rudimentary software. I can't say too much about this project, as it is still 'under wraps', but I wouldn't be surprised to see Digital Research's GEM (as used on the Atari 'Jackintosh') running on the QL before long. Martin Baines of CST announced they were working on a very versatile expansion system, which would allow users to have disks, RAM expansion, and up to two other peripherals, all 'on-line' at

once. Medic were there in force, with pre-production samples of their combined disk interface, .5 Mb RAM, parallel printer port, and user socket.

An IGLUG member has developed a piece of software that allows any key to have a string or even a whole program assigned to it. The new key definitions are accessed by first pressing the "CAPS LOCK" key. Pre-defined libraries are provided for use with SuperBasic programming and Quill, and a utility is supplied enabling the user to define his own libraries.

Another product recently introduced is a Zilog Z8 single-chip processor. This forms the basis for an 'intelligent' peripheral card interfaced to the QL via one of the serial ports. It is being used for programming EPROMS at present, but other applications that spring to mind are: serial/parallel conversion, modem control, robotics, and a cassette interface (for reading Spectrum programs and data into the QL).

On an entirely different tack, the Open University are

working on a course entitled 'Design and Innovation', which incorporates a case study on the design and marketing of the QL. Bearing in mind the QL's chequered history this should make interesting reading.

Finally, we have just been informed that a Danish software house has a contract to translate the Psion packages into Danish. Apparently similar translations are in progress into Spanish, French, Italian and German. It looks as though Sinclair is serious about the QL in Europe.

The Independent QL Users' Group (IQLUG) publishes a monthly newsletter, maintains a software library, supports local groups, and provides members with a free advice service. Workshops are arranged from time to time in different parts of the country. Further details are available from:  
Brian Pain, 24 Oxford Street, Stony Stratford, Milton Keynes MK11 1JU. Tel: (0908) 564271

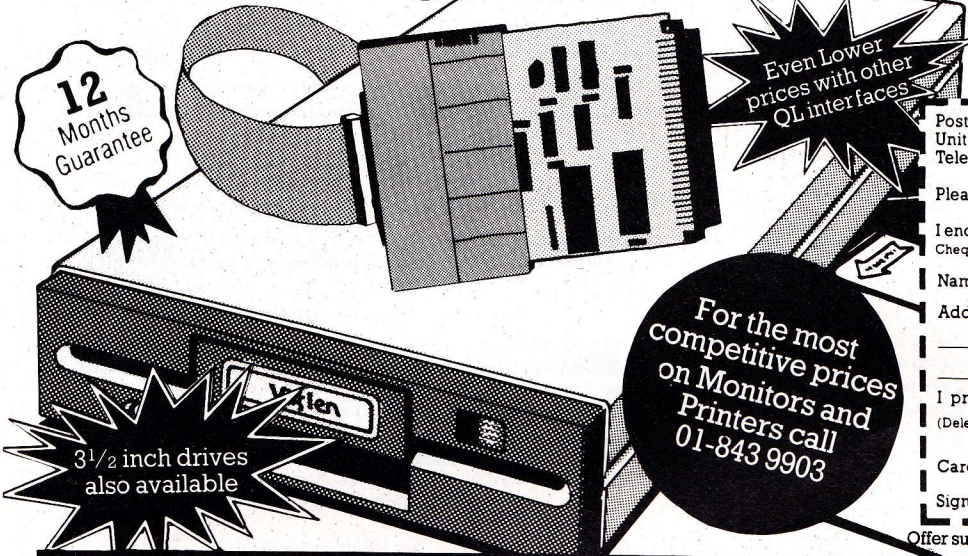


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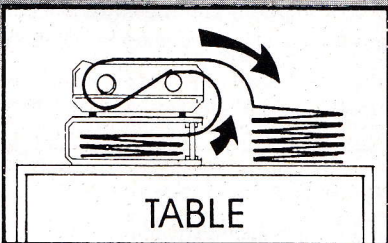
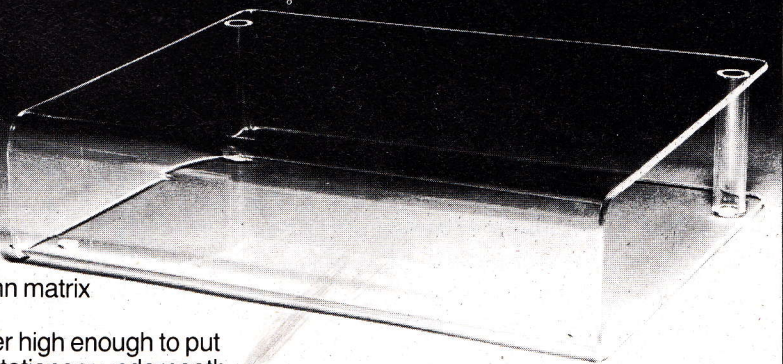
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QLU6

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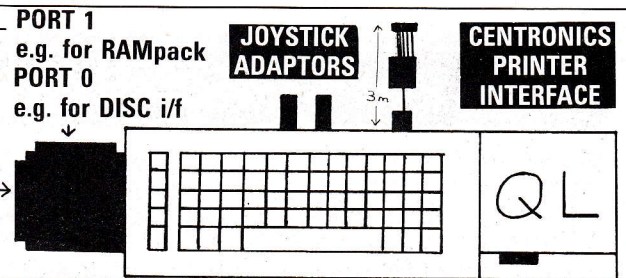
MicroP 1st 3½" drive + P.S. + disk interface 720k formatted.....	<b>£294</b>
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## SCREEN DUMP

### CENTRONICS PRINTER INTERFACE £29.95 inc.

- ★ 12 month guarantee.
- ★ Connects QL to any CENTRONICS compatible printer. fully self-contained with 3 metre cable.
- ★ Plugs directly into SER1 port and directly into printer.
- ★ Fully compatible with QDOS, SuperBasic, and PSION packages.

### SCREEN DUMP £4.99 inc.

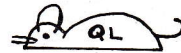
- ★ Copies QL screen image to printer.
- ★ Supplied on microdrive cartridge.
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# THE PROGS

## DIY Assembler

Giles Todd

At long last, the final episode. Over the last four months the program has been through a

battery of tests. The results reveal that two lines need to be altered. They are 3510 and 5640. Corrected, these appear in full at the end of the listing.

```
11600 :
11610 DEFine PROCedure link23
11620 SELEct ON stype=3 TO 16:operr
11630 SELEct ON dtype=3 TO 16:operr
11640 word(0)=shift(15)+shift(14)+shift(8)
11650 IF stype=1 AND dtype=1 THEN
11660   word(0)=word(0)+reg(src$,stype)*shift(9)+
8*shift(3)+reg(dest$,dtype)
11670 END IF
11680 IF stype=2 AND dtype=2 THEN
11690   word(0)=word(0)+reg(src$,stype)*shift(9)+
9*shift(3)+reg(dest$,dtype)
11700 END IF
11710 IF stype=1 AND dtype=2 THEN
11720   word(0)=word(0)+reg(dest$,dtype)*shift(9)
+17*shift(3)+reg(src$,stype)
11730 END IF
11740 IF stype=2 AND dtype=1 THEN
11750   word(0)=word(0)+reg(src$,stype)*shift(9)+
17*shift(3)+reg(dest$,dtype)
11760 END IF
11770 object$=cvs$(word(0),2)
11780 program_counter=program_counter+2
11790 END DEFine link23
11800 :
11810 DEFine PROCedure link27
11820 LOCAL length
11830 SELEct ON stype=2,14 TO 16:operr
11840 SELEct ON dtype=2 TO 16:operr
11850 word(0)=shift(15)+shift(14)+shift(7)+shift(6)
+reg(dest$,dtype)*shift(9)+amode(stype)*shift(3)+
reg(src$,stype)
11860 length=2+overhead(stype,mn$,src$)
11870 opcode
11880 program_counter=program_counter+length
11890 END DEFine link27
11900 :
11910 DEFine PROCedure status
11920 LOCAL length
11930 IF dest$="CCR" THEN
11940   word(0)=shift(14)+shift(10)+shift(7)+shif
t(6)+amode(stype)*shift(3)+reg(src$,stype)
11950   length=2+overhead(stype,mn$,src$)
11960   opcode
11970 END IF
11980 IF dest$="SR" THEN
11990   word(0)=shift(14)+shift(10)+shift(9)+shif
t(7)+shift(6)+amode(stype)*shift(3)+reg(src$,stype)
)
12000   length=2+overhead(stype,mn$,src$)
12010   opcode
12020 END IF
12030 IF src$="SR" THEN
12040   word(0)=shift(14)+shift(7)+shift(6)+amode
(dtype)*shift(3)+reg(dest$,dtype)
12050   length=2+overhead(dtype,mn$,dest$)
12060   opcode
12070 END IF
12080 IF src$="USP" OR dest$="USP" THEN
12090   word(0)=shift(14)+shift(11)+shift(10)+shi
ft(9)+shift(6)+shift(5)
12100   IF src$="USP" THEN word(0)=word(0)+shift(
3)+reg(dest$,dtype)
12110   IF dest$="USP" THEN word(0)=word(0)+reg(s
rc$,stype)
12120   length=2
12130   object$=cvs$(word(0),2)
12140 END IF
12150 program_counter=program_counter+length
12160 END DEFine status
12170 :
12180 DEFine PROCedure link20
12190 LOCAL length
12200 IF NOT (stype=1 AND dtype=1) AND NOT (stype=
5 AND dtype=5) THEN operr
12210 word(0)=shift(15)+shift(14)+shift(8)+(stype=
5)*shift(3)+reg(dest$,dtype)*shift(9)+reg(src$,sty
pe)
```

```
12220 length=2
12230 object$=cvs$(word(0),2)
12240 program_counter=program_counter+length
12250 END DEFine link20
12260 :
12270 DEFine PROCedure link1
12280 LOCAL i,length,size,temp$
12290 sizetemp
12300 IF temp$(i)="I" OR stype=12 OR stype=13 THEN
12310 IF stype<>12 AND stype<>13 THEN operr
12320 SELEct ON dtype=2,10 TO 16:operr
12330   word(0)=shift(9)+size*shift(6)
12340   IF dest$="SR" THEN
12350     word(0)=word(0)+60
12360   ELSE
12370     word(0)=word(0)+amode(dtype)*shift(3)+
reg(dest$,dtype)
12380   END IF
12390 ELSE
12400   word(0)=shift(15)+shift(14)
12410   IF dtype=1 THEN
12420   IF stype=2 THEN operr
12430     word(0)=word(0)+reg(dest$,dtype)*shift
(9)+size*shift(6)+amode(stype)*shift(3)+reg(src$,s
type)
12440   ELSE
12450   IF stype<>1 THEN operr
12460   SELEct ON dtype=2,10 TO 16:operr
12470     word(0)=word(0)+reg(src$,stype)*shift(
9)+shift(8)+size*shift(6)+amode(dtype)*shift(3)+re
g(src$,stype)
12480   END IF
12490 END IF
12500 length=2+overhead(stype,mn$,src$)+overhead(d
type,mn$,dest$)
12510 opcode
12520 program_counter=program_counter+length
12530 END DEFine link1
12540 :
12550 DEFine PROCedure link2
12560 LOCAL i,length,size,temp$
12570 sizetemp
12580 IF dest$="" THEN
12590 SELEct ON stype=1,2,10 TO 16:operr
12600   word(0)=word(0)+shift(15)+shift(14)+shift
(13)+shift(8)+shift(7)+shift(6)+amode(stype)*shift
(3)+reg(src$,stype)
12610   length=2+overhead(stype,mn$,src$)
12620   opcode
12630 ELSE
12640 IF dtype<>1 THEN operr
12650   word(0)=shift(15)+shift(14)+shift(13)+shi
ft(8)+size*shift(6)+reg(dest$,dtype)
12660   IF stype=1 THEN
12670     word(0)=word(0)+reg(src$,stype)*shift(
9)+shift(5)
12680   ELSE
12690     word(0)=word(0)+(eval(src$) MOD 8)*shi
ft(9)
12700   END IF
12710   length=2
12720   object$=cvs$(word(0),2)
12730 END IF
12740 program_counter=program_counter+length
12750 END DEFine link2
12760 :
12770 DEFine PROCedure link3
12780 link2
12790 word(0)=word(0)-shift(8)
12800 opcode
12810 END DEFine link3
12820 :
12830 DEFine PROCedure link39
12840 LOCAL length
12850 SELEct ON stype=2 TO 11,14 TO 16:operr
12860 SELEct ON dtype=2,10 TO 16:operr
12870 IF stype=1 THEN
12880   word(0)=shift(8)+shift(6)+reg(src$,stype)
+amode(dtype)*shift(3)+reg(dest$,dtype)
12890 ELSE
12900   word(0)=shift(11)+shift(6)+amode(dtype)*s
hift(3)+reg(dest$,dtype)
12910 END IF
12920 length=2+overhead(stype,mn$,src$)+overhead(d
type,mn$,dest$)
```

# THE PROGS

```

12930 opcode
12940 program_counter=program_counter+length
12950 END DEFine link39
12960 :
12970 DEFine PROCedure link40
12980 link39
12990 word(0)=word(0)+shift(7)-shift(6)
13000 opcode
13010 END DEFine link40
13020 :
13030 DEFine PROCedure link6
13040 LOCAL temp,disp
13050 word(0)=shift(14)+shift(13)+shift(8)
13060 temp=eval(src$)
13070 program_counter=program_counter+2
13080 disp=temp-program_counter
13090 IF disp>=-126 AND disp<0 OR mn$(LEN(mn$)-1 T
0)="S" THEN
13100     IF disp<0 THEN word(0)=word(0)+256+disp
13110     IF disp>=0 THEN word(0)=word(0)+disp
13120     object$=cvs$(word(0),2)
13130 ELSE
13140     object$=cvs$(word(0),2)&cvs$(disp,2)
13150     program_counter=program_counter+2
13160 END IF
13165 IF mn$(LEN(mn$)-1 TO)=="S" AND (disp<-128 O
R disp>127) THEN operr
13170 END DEFine link6
13180 :
13190 DEFine PROCedure link42
13200 LOCAL length
13210 IF stype=2 OR dtype<>1 THEN operr
13220 word(0)=shift(14)+shift(8)+shift(7)+reg(dest
$,dtype)*shift(9)+amode(stype)*shift(3)+reg(src$,s
type)
13230 length=2+overhead(stype,mn$,src$)
13240 opcode
13250 program_counter=program_counter+length
13260 END DEFine link42
13270 :
13280 DEFine PROCedure link43
13290 LOCAL length
13300 IF stype=2 OR dtype<>1 THEN operr
13310 word(0)=shift(15)+shift(8)+shift(7)+shift(6)
+reg(dest$,dtype)*shift(9)+amode(stype)*shift(3)+r
eg(src$,stype)
13320 length=2+overhead(stype,mn$,src$)
13330 opcode
13340 program_counter=program_counter+length
13350 END DEFine link43
13360 :
13370 DEFine PROCedure link44
13380 link43
13390 word(0)=word(0)-shift(8)
13400 opcode
13410 END DEFine link44
13420 :
13430 DEFine PROCedure link9
13440 LOCAL i,length,size,temp$
13450 sizetemp
13460 IF temp$(i)="I" THEN
13470 IF stype<>12 AND stype<>13 THEN operr
13480 SElect ON dtype=2,10 TO 16:operr
13490 word(0)=shift(11)+shift(9)+size*shift(6)+
amode(dtype)*shift(3)+reg(dest$,dtype)
13500 ELSE
13510 word(0)=shift(15)+shift(13)+shift(12)+shi
ft(8)+reg(src$,stype)*shift(9)+amode(dtype)*shift(
3)+reg(dest$,dtype)
13520 END IF
13530 length=2+overhead(stype,mn$,src$)+overhead(d
type,mn$,dest$)
13540 opcode
13550 program_counter=program_counter+length
13560 END DEFine link9
13570 :
13580 DEFine PROCedure link10
13590 SElect ON stype=1,2,4,5,12 TO 16:operr
13600 word(0)=shift(14)+shift(11)+shift(10)+shift(
9)+shift(7)+shift(6)+amode(stype)*shift(3)+reg(src
$,stype)
13610 length=2+overhead(stype,mn$,src$)
13620 opcode
13630 program_counter=program_counter+length
13640 END DEFine link10
13650 :
13660 DEFine PROCedure link11
13670 link10
13680 word(0)=word(0)-shift(6)
13690 opcode
13700 END DEFine link11
13710 :
13720 DEFine PROCedure link46
13730 LOCAL length
13740 IF dtype<>2 THEN operr
13750 SElect ON stype=1,2,4,5,12 TO 16:operr
13760 word(0)=shift(14)+shift(8)+shift(7)+shift(6)
+reg(dest$,dtype)*shift(9)+amode(stype)*shift(3)+r
eg(src$,stype)
13770 length=2+overhead(stype,mn$,src$)
13780 opcode
13790 program_counter=program_counter+length
13800 END DEFine link46
13810 :
13820 DEFine PROCedure link47
13830 LOCAL length
13840 IF stype<>2 THEN operr
13850 word(0)=shift(14)+shift(11)+shift(10)+shift(
9)+shift(6)+shift(4)+reg(src$,stype)
13860 length=4
13870 opcode
13880 program_counter=program_counter+length
13890 END DEFine link47
13900 :
13910 DEFine PROCedure link13
13920 link12
13930 word(0)=word(0)-shift(8)
13940 IF stype=1 OR stype=12 OR stype=13 THEN obje
ct$=cvs$(word(0),2):ELSE opcode
13950 END DEFine link13
13960 :
13970 DEFine PROCedure link25
13980 LOCAL i,length,size,temp$
13990 IF NOT (stype=1 AND dtype=6) AND NOT (stype=
6 AND dtype=1) THEN operr
14000 sizetemp
14010 word(0)=shift(8)+shift(3)+(size=2)*shift(6)
14020 IF stype=1 THEN
14030 word(0)=word(0)+shift(7)+reg(src$,stype)*
shift(9)+reg(dest$,dtype)
14040 ELSE
14050 word(0)=word(0)+reg(dest$,dtype)*shift(9)
+reg(src$,stype)
14060 END IF
14070 length=4
14080 opcode
14090 program_counter=program_counter+length
14100 END DEFine link25
14110 :
14120 DEFine PROCedure link26
14130 LOCAL length
14140 SElect ON stype=2,14 TO 16:operr
14150 IF dtype<>1 THEN operr
14160 word(0)=shift(15)+shift(14)+shift(8)+shift(7)
+shift(6)+reg(dest$,dtype)*shift(9)+amode(stype)*
shift(3)+reg(src$,stype)
14170 length=2+overhead(stype,mn$,src$)
14180 opcode
14190 program_counter=program_counter+length
14200 END DEFine link26
14210 :
14220 DEFine PROCedure link48
14230 LOCAL length
14240 SElect ON stype=2,10 TO 16:operr
14250 word(0)=shift(14)+shift(11)+amode(stype)*shi
ft(3)+reg(src$,stype)
14260 length=2+overhead(stype,mn$,src$)
14270 opcode
14280 program_counter=program_counter+length
14290 END DEFine link48
14300 :
14310 DEFine PROCedure link28
14320 LOCAL i,length,size,temp$
14330 SElect ON stype=2,10 TO 16:operr
14340 sizetemp
14350 word(0)=shift(14)+shift(10)+size*shift(6)+am
ode(stype)*shift(3)+reg(src$,stype)
14360 IF temp$(i)="X" THEN word(0)=word(0)-shift(1
0)
14370 length=2+overhead(stype,mn$,src$)

```

# THE PROGS

```

14380 opcode
14390 program_counter=program_counter+length
14400 END DEFine link28
14410 :
14420 DEFine PROCedure link29
14430 word(0)=shift(14)+shift(11)+shift(10)+shift(
9)+shift(6)+shift(5)+shift(4)+shift(0)
14440 object%=cvs$(word(0),2)
14450 program_counter=program_counter+2
14460 END DEFine link29
14470 :
14480 DEFine PROCedure link15
14490 LOCAL i,length,size,temp$
14500 sizetemp
14510 link1
14520 IF temp$(i)="I" THEN
14530   word(0)=word(0)-shift(9)
14540 ELSE
14550   word(0)=word(0)-shift(14)
14560 END IF
14570 opcode
14580 END DEFine link15
14590 :
14600 DEFine PROCedure link49
14610 LOCAL length
14620 SELECT ON stype=1,2,4,5,12 TO 16:operr
14630 word(0)=shift(14)+shift(11)+shift(6)+amode(s
type)*shift(3)+reg(src$,stype)
14640 length=2+overhead(stype,mn$,src$)
14650 opcode
14660 program_counter=program_counter+length
14670 END DEFine link49
14680 :
14690 DEFine PROCedure link50
14700 word(0)=shift(14)+shift(11)+shift(10)+shift(
9)+shift(6)+shift(5)+shift(4)
14710 object%=cvs$(word(0),2)
14720 program_counter=program_counter+2
14730 END DEFine link50
14740 :
14750 DEFine PROCedure link16
14760 link17
14770 word(0)=word(0)+shift(8)
14780 IF stype=12 OR stype=1 THEN object%=cvs$(wor
d(0),2):ELSE opcode
14790 END DEFine link16
14800 :
14810 DEFine PROCedure link17
14820 link13
14830 IF stype=12 OR stype=1 THEN
14840   word(0)=word(0)+shift(4)
14850   object%=cvs$(word(0),2)
14860 ELSE
14870   word(0)=word(0)+shift(10)
14880   opcode
14890 END IF
14900 END DEFine link17
14910 :
14920 DEFine PROCedure link31
14930 link16
14940 IF stype=12 OR stype=1 THEN
14950   word(0)=word(0)-shift(3)
14960   object%=cvs$(word(0),2)
14970 ELSE
14980   word(0)=word(0)-shift(9)
14990   opcode
15000 END IF
15010 END DEFine link31
15020 :
15030 DEFine PROCedure link32
15040 link31
15050 word(0)=word(0)-shift(8)
15060 IF stype=12 OR stype=1 THEN object%=cvs$(wor
d(0),2):ELSE opcode
15070 END DEFine link32
15080 :
15090 DEFine PROCedure link33
15100 word(0)=shift(14)+shift(11)+shift(10)+shift(
9)+shift(6)+shift(5)+shift(4)+shift(1)+shift(0)
15110 object%=cvs$(word(0),2)
15120 program_counter=program_counter+2
15130 END DEFine link33
15140 :
15150 DEFine PROCedure link34
15160 word(0)=shift(14)+shift(11)+shift(10)+shift(
9)+shift(6)+shift(5)+shift(4)+shift(2)+shift(1)+sh
ift(0)
15170 object%=cvs$(word(0),2)
15180 program_counter=program_counter+2
15190 END DEFine link34
15200 :
15210 DEFine PROCedure link35
15220 link20
15230 word(0)=word(0)-shift(14)
15240 object%=cvs$(word(0),2)
15250 END DEFine link35
15260 :
15270 DEFine PROCedure link51
15280 LOCAL length,i,temp
15290 SELECT ON stype=2,10 TO 16:operr
15300 FOR i=0 TO 15
15310 IF mn$="S"&condition$(i) THEN
15320   temp=cond%(i)
15330   EXIT i
15340 END IF
15350 END FOR i
15360 word(0)=shift(14)+shift(12)+temp*shift(8)+sh
ift(7)+shift(6)+amode(stype)*shift(3)+reg(src$,sty
pe)
15370 length=2+overhead(stype,mn$,src$)
15380 opcode
15390 program_counter=program_counter+length
15400 END DEFine link51
15410 :
15420 DEFine PROCedure link36
15430 word(0)=hex("4E72")
15440 opcode
15450 program_counter=program_counter+4
15460 END DEFine link36
15470 :
15480 DEFine PROCedure link37
15490 IF stype<>1 THEN operr
15500 word(0)=shift(14)+shift(11)+shift(6)+reg(src
$,stype)
15510 object%=cvs$(word(0),2)
15520 program_counter=program_counter+2
15530 END DEFine link37
15540 :
15550 DEFine PROCedure link52
15560 LOCAL length
15570 SELECT ON stype=2,10 TO 16:operr
15580 word(0)=shift(14)+shift(11)+shift(9)+shift(7
)+shift(6)+amode(stype)*shift(3)+reg(src$,stype)
15590 length=2+overhead(stype,mn$,src$)
15600 opcode
15610 program_counter=program_counter+length
15620 END DEFine link52
15630 :
15640 DEFine PROCedure link53
15650 IF stype<>12 THEN operr
15660 word(0)=shift(14)+shift(11)+shift(10)+shift(
9)+shift(6)+(eval(src$) MOD 16)
15670 object%=cvs$(word(0),2)
15680 program_counter=program_counter+2
15690 END DEFine link53
15700 :
15710 DEFine PROCedure link54
15720 word(0)=hex("4E76")
15730 object%=cvs$(word(0),2)
15740 program_counter=program_counter+2
15750 END DEFine link54
15760 :
15770 DEFine PROCedure link55
15780 IF stype<>2 THEN operr
15790 word(0)=shift(14)+shift(11)+shift(10)+shift(
9)+shift(6)+shift(4)+shift(3)+reg(src$,stype)
15800 object%=cvs$(word(0),2)
15810 program_counter=program_counter+2
15820 END DEFine link55
15830 :
15840 DEFine PROCedure link24
15850 LOCAL i,j,rlist$,length,temp$,delim$,size
15860 sizetemp
15870 IF stype=16 THEN
15880 SELECT ON dtype=1,2,4,10 TO 16:operr
15890   rlist%=src$
15900   word(0)=shift(14)+shift(11)+shift(7)+amod
e(dtype)*shift(3)+reg(dest$,dtype)
15910   length=2+overhead(dtype,mn$,dest$)
15920 ELSE

```

# THE PROGS

```
15930 IF dtype<>16 THEN operr
15940 SElect ON stype=1,2,5,12 TO 16:operr
15950   rlist$=dest$
15960   word(0)=shift(14)+shift(11)+shift(10)+shi
ft(7)+amode(stype)*shift(3)+reg(src$,stype)
15970   length=2+overhead(stype,mn$,src$)
15980 END IF
15990 IF size=2 THEN word(0)=word(0)+shift(6)
16000 opcode
16010 word(1)=0
16020 REpeat j
16030   IF rlist$="" THEN EXIT j
16040   IF ("-" INSTR rlist$ OR "/" INSTR rlist$)
THEN temp$=rlist$(1 TO 3):rlist$=rlist$(4 TO):ELS
E temp$=rlist$:rlist$=""
16050   delim$=temp$(LEN(temp$)):IF delim$<>"/" A
ND delim$<>"-" THEN delim$=""
16060   IF delim$="/" THEN reglist temp$,dtype:NE
XT j
16070   IF delim$="" THEN reglist temp$,dtype:EXI
T j
16080   IF delim$="-" THEN
16090     delim$=rlist$(1 TO 2)
16100     IF LEN(rlist$)>2 THEN
16110       IF rlist$(3)="/" THEN rlist$=rlist$
(4 TO):ELSE rlist$=rlist$(3 TO)
16120     ELSE
16130       rlist$=""
16140     END IF
16150     FOR i=temp$(2) TO delim$(2)
16160       reglist temp$(1)&i,dtype
16170     END FOR i
16180   END IF
16190 END REpeat j
16200 IF LEN(object$)>2 THEN object$=object$(1 TO
2)&cvs$(word(1),2)&object$(3 TO): ELSE object$=ob
ject$&cvs$(word(1),2)
16210 length=length+2
16220 program_counter=program_counter+length
16230 END DEFine link24
16240 :
16250 DEFine PROCedure reglist(temp$,dtype)
16260 LOCAL i
16270 i=reg(temp$(1 TO 2),0)
16280 IF temp$(1)="A" THEN i=i+8
16290 IF dtype=5 THEN i=15-i
16300 word(1)=word(1)+shift(i)
16310 END DEFine reglist
16320 :
16330 DEFine FuNction expression(t$)
16340 LOCAL temp,t1$,t2$,op$,k,i
16345 IF t$="[*]" THEN RETURN program_counter
16350 t$=t$("[" INSTR t$)+1 TO ("]" INSTR t$)-1)
16360 FOR i=1 TO LEN(t$)
16370 IF t$(i)="+" OR t$(i)="-" THEN
16380   op$=t$(i)
16390   t1$=t$(1 TO i-1)
16400   t$=t$(i+1 TO)
16410   EXIT i
16420 END IF
16430 END FOR i
16440 temp=eval(t1$)
16450 REpeat k
16460 FOR i=1 TO LEN(t$)
16470 IF t$(i)="+" OR t$(i)="-" THEN
16480   t2$=t$(1 TO i-1)
16490   IF op$="+" THEN temp=temp+eval(t2$):ELSE
temp=temp-eval(t2$)
16500   op$=t$(i)
16510   IF LEN(t$)>i THEN t$=t$(i+1 TO):ELSE t$=""
16520   EXIT i
16530 END IF
16540 END FOR i
16550 IF t$="" THEN EXIT k
16560 IF NOT("+" INSTR t$ OR "-" INSTR t$) THEN
16570   IF op$="+" THEN temp=temp+eval(t$):ELSE te
mp=temp-eval(t$)
16580   EXIT k
16590 END IF
16600 END REpeat k
16610 RETURN temp
16620 END DEFine expression
16630 :
16640 DEFine PROCedure operr
```

```
16650 error_count=ferror("Operand error",error_cou
nt)
16660 END DEFine operr
16670 :
16680 DEFine PROCedure display_errors(ec)
16690 PRINT:PRINT
16700 PRINT ec;" errors were detected"
16710 END DEFine display_errors
16720 :
30000 DEFine PROCedure tape
30010 DELETE mdv1_assembler
30020 SAVE mdv1_assembler
30030 DELETE mdv2_assembler
30040 SAVE mdv2_assembler
30050 END DEFine tape
3510 IF (s$="I" AND temp$<>"BHI" AND temp$<>"SHI"
AND temp$<>"DBHI" AND temp$<>"BMI" AND temp$<>"SMI"
" AND temp$<>"DBMI") OR (s$="A" AND temp$<>"DBRA"
AND temp$<>"BRA" AND temp$<>"LEA" AND temp$<>"PEA"
) OR s$="X" OR (s$="Q" AND temp$<>"DBEQ" AND temp$
<>"BEQ" AND temp$<>"SEQ") OR (s$="M" AND temp$="CM
PM") THEN
5640 IF (temp>=-32768 AND temp<=32767 AND NOT i
nside(".L",field$) ) OR inside(".W",field$) OR ins
ide(".B",field$) THEN
```

## Mail Merge

Ian Rolfe

This program takes a Quill-*lis* file and converts it to run on Archive. Database names on the Quill document should be enclosed between copyright symbols (ie "Dear ©client\$©

etc). When complete the document should be PRINTed to mdv2\_, Quill abandoned and this program RUN. The *\_prg* file may then be LOAded or MERGEd into Archive. To mailmerge the current record type mailmerge.

```
100 REMark *****
110 REMark ** MailMerge **
120 REMark ** By I.D. Rolfe **
130 REMark ** 27.3.85 **
140 REMark *****
150 REMark ** Converts Quill_lis file **
160 REMark ** to Archive_prg file **
170 REMark *****
180 REMark
190 RESTORE
200 CLS:INPUT"Quill_lis File Name?"!file$
210 INPUT"Archive_prg File Name?"!pfile$
220 REMark READ STRING USED BY PRINTER FOR END OF LINE
eol$=""
230 REPEAT eol:READ e:eol$=eol$&CHR$(e):IF EOF:EXIT eol
240 OPEN_IN#3,"mdv2_ "&!file$&"_lis"
250 OPEN_NEW#4,"mdv2_ "&!pfile$&"_prg"
260 PRINT"Converting"!file$;"_lis to"!pfile$;"_prg..."
270 PRINT#4,"proc mailmerge"&CHR$(13)
280 l=1
290 REPEAT convert
300 line$=""
310 AT 15,0:PRINT"Line"!l
320 REPEAT inline
330 IF EOF(#3):EXIT inline
340 ch$=INKEY$(#3,-1):IF ch$=eol$(1):FOR c=2 TO LEN(eol$):
ch$=INKEY$(#3):END FOR c:EXIT inline
350 IF CODE(ch$)>=32:line$=line$&ch$:ELSE line$=line$&'&
chr(0)&chr('CODE(ch$)'):EXIT inline
360 END REPEAT inline
370 l=l+1
380 IF line$=""!PRINT#4,"!print"&CHR$(13):NEXT convert
390 vars
400 PRINT#4,"!print "&line$;
410 IF line$(LEN(line$))<>";":PRINT#4,"";
420 PRINT#4,CHR$(13)
430 IF EOF(#3):EXIT convert
440 END REPEAT convert
450 CLOSE#3
460 PRINT#4,"endproc"&CHR$(13):PRINT#4,CHR$(26);
470 CLOSE#4
480 STOP
490 REMark PROCEDURE TO FIND VARIABLE ENCLOSED IN '©' SIGNS
500 DEFine PROCedure vars
510 c2=0
520 c="©"INSTR line$
530 IF c>c2:insvar=60 TO 520
540 END DEFine
550 REMark PROCEDURE TO INSERT VARIABLE INTO ARCHIVE LPRINT STATEMENT
560 DEFine PROCedure insvar
570 line$=line$(c+1 TO LEN(line$))
580 c1="©"INSTR line$
590 line$=line$(1 TO c-1)&" "&line$(1 TO c1-1)
600 IF LEN(line$)=c1:line$=line$&";":RETURN
610 line$=line$(c1+1 TO LEN(line$))
620 sc=0:REPEAT space
630 IF line$(1)<>" ":EXIT space
640 line$=line$(2 TO LEN(line$)):sc=sc+1
650 END REPEAT space
660 IF sc>0:line$=line$&'& tab '&(c+c1+sc)&'& "&line$:ELSE
line$=line$&'& "&line$
670 c2=c
680 END DEFine
690 REMark DATA FOR END OF LINE CODES
700 DATA 13,10
```

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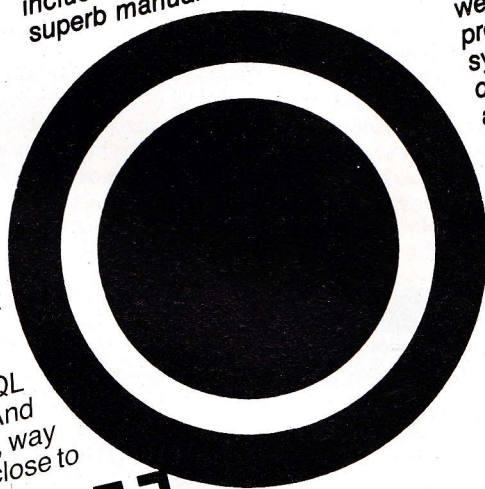
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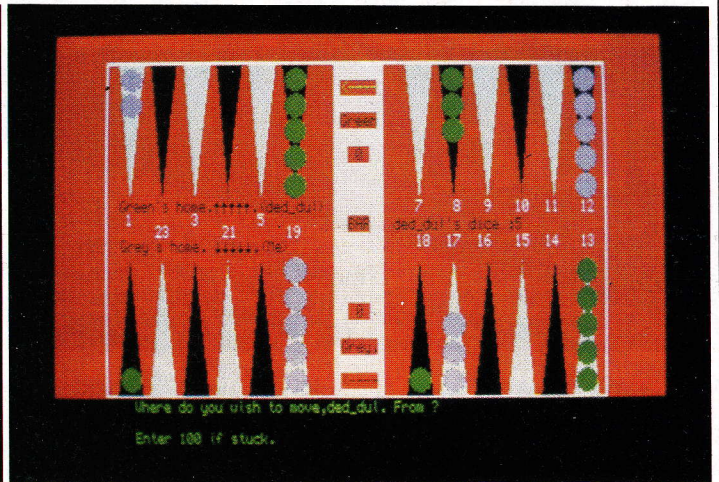
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# SOFTWARE FILE

Chris Jenkins starts off a new regular feature – reviewing the latest in QL software.



Screens from two of Digital Precision's range — Sprite Generator and Backgammon.

## SUPER SPRITE GENERATOR

The *Super Sprite Generator* is a well-designed and carefully planned utility which will no doubt prove invaluable to many QL owners. Sprites – user-defined moveable object blocks, if you prefer – are one of the unfortunate omissions on the Sinclair machines, though Commodore 64 owners among others are lucky enough to have sprite handling routines in ROM.

*Super Sprite Generator* takes all the hard work out of designing and handling sprites by giving extensions to SuperBasic. There's a full demo routine showing everything the program is capable of, including sprite design with up to 16 shapes per sprite, up to 16 sprites on screen at a time, 256 planes for depth of movement, collision detection, sprite reversal and inversion, and so on.

Part of the demo program shows graphics produced with normal SuperBasic, the sun and a space platform, along with earth sprites, an alien and a building. You can list this demo to find out how the extension command words have been used, or go on to the design section. Here, you simply select a frame number and colour in a grid using the cursor keys and colour selection. Your sprite appears true size in a block on the left hand side of the screen.

After saving the sprite you can go on to create varying frame versions, then use the

Construct program to combine the versions into a sprite file. The SuperBasic extensions are then used to activate, control and animate the sprite in your own programs.

This is the only difficult part of the program, since the functions relating to movement, collisions, planes and so on have quite complex parameters. Still, it's worth putting in the effort to get used to the system, since the results which can be achieved are simply excellent.

*Digital Precision*

## SUPER BACKGAMMON

*Super Backgammon* is an implementation of the increasingly popular boardgame which works very well. For those of you unfamiliar with the game, it's thought to be the oldest surviving dice game, and involves two players. In the case of *Super Backgammon* you can play against an opponent or against the computer, but be warned – the computer will almost certainly beat you!

The game is played with counters arrayed on 24 lines, set 12 on each side of the board. The idea is to throw dice to determine the movements of the 30 counters. The first player to remove all his counters from the board wins, though in the final stages when the players are 'bearing off' the action becomes quite complex.

The program includes full instructions on the insert, and

on a help page. After choosing whether to read them or not, you go on to enter the play options: an automatic display by the QL, one player against the machine (plus play level), or two players. You can also choose to have the machine throw the dice, or to do it yourself – the QL trusts you not to cheat!

Moves are registered simply by keying in the start and end numbers of lines you wish to move between – if it's an illegal move, it will be ignored. 100 can be entered if there's no possible legal move, or if you want a suggestion from the machine. It's this attention to detail which makes the package so enjoyable to use.

*Digital Precision*

## GUMSHOE LOGIC

Although *Gumshoe Logic* is attractively 'packaged', the actual details of the program are a disappointment.

You are in charge of a detective agency, and must select a case at your required level of difficulty, then solve it within your budget. If you can buy all the information needed to solve each case you'll receive a payment, and can move to a higher level; if not, you'd better get out of town.

Your four opening options are Case Description, Financial Status, Catalogue of Snouts and Proceed With Case. It's only when you get the case description that you realise what form the program takes; it's a form of simple logic puzzle. You are given, for instance, the names of four

criminals, four rackets and four henchmen, and have to match them up by buying useful information from your informants. Some tell the truth, some lie, some offer good value for money and some don't, so it's quite tricky to sort out the right answers and present the solution.

In addition the author suffers from a terminal case of confused phraseology; if you're a 'gumshoe', and the villains have names like 'Scaramanga' and 'Rocco', why are you paid in Sterling? And isn't 'snout' a bit more Dixon of Dock Green than Miami Vice? Hey, better wise up, punks – try to make it on the streets with a product like this, and you'd end up as TOAST, ok?

*Megacycal Software Ltd*

## BRIDGE PLAYER

*Bridge Player* caters well for the experienced player, but it's doubtful as to whether it's suitable for anyone learning the game. As someone who hasn't played bridge for years (and never of great proficiency in any case) it was disappointing to find that *Bridge Player* didn't rekindle my interest in the game.

Great virtue is made of the fact that the deal is random, but I'd have thought that was a prerequisite for a program of this kind in any case.

ACOL bidding and Gerber and Stayman conventions, using a strong two club bid are among the program's parameters: anyone advanced enough to make sense of that won't need a computerised



opponent!

Still, the screen presentation of the cards is bright and well-designed, and there are a number of useful facilities. Any particular hand can be replayed, and holding down the space bar will make the computer play your turn, either as defender or declarer.

The scoring display is reasonably good, and takes into account doubles, redoubles and slam bonuses. Overall a testing game for experienced bridge players, but perhaps less useful for beginners.  
*CP Software*

## AREA RADAR

### CONTROLLER

It was no go with *Area Radar Controller*, although this may have been because I didn't have a full set of instructions. Still, a program should be clear enough so that it's possible to work through it in some way without needing an enormous manual.

This is the kind of 'flight simulator' which offers you, not the pleasure of flight itself, but that of watching other people fly. The display, which features unimpressive graphics, represents an air traffic zone which includes two airfields and nine major traffic routes.

At the beginning of the game the number of aircraft you wish to control (from 10 to 69) are selected. The command line at the bottom of the screen allows you to communicate with the aircraft flying into the zone, each of which is identified with a code number. More often than not I received a message saying "Aircraft Does Not Respond", which isn't much help, and had to watch hopelessly as they overshot the runway and ran out of fuel.

Other errors include allowing planes to enter the wrong approach lane, and allowing collisions, which are quite spectacular. Your performance is graded at the end - I didn't manage much better than "appalling", and lacked incentive to work on improving the situation.  
*Shadow Soft*

## EXECUTIVE

### ADVENTURE

It would be nice to see more packages like *Executive Adventure* appearing for the QL, for two reasons. Firstly, the memory size makes the machine ideal for text

adventures, which some people like to be as complicated as possible. Secondly, the program attempts to demonstrate some sense of humour. Unfortunately this program was a non-starter for a couple of reasons.

The premise is much like that of the recent Spectrum adventure *Hampstead*. You start without status and possessions, and must rise to a position of eminence using only your wits and intelligence.

You start as a tramp on a park bench, who imagines himself as a successful executive in a nice warm boardroom (nothing here about the pressures of the business world, you'll notice - it's all supposed to be luxury).

One irritation is that the computer's instructions, which are presented with no attempt at producing any form of interesting screen display, are quite misleading. You are told that you're penniless, but on examining my pockets I found a coin. The computer then asks what you want to do with the coin, but I couldn't get any useful response. The only alternative was to wander off into the park - ignoring the advice to examine my pockets every time I asked for HELP - and get lost.

Any adventure which introduces the obligatory maze right at the start must be desperate for ideas, and after half an hour's fruitless wandering I gave up and returned to the park bench for a good night's sleep.  
*Intersoft*

## SUPER MONITOR

*QL Super Monitor* isn't the first package of its kind to become available, and doesn't offer much that hasn't been seen before. Still, it's a good basic utility and seems to function with no problems at all.

All numbers are given in hexadecimal, which makes things simple, but it might have been better to allow more flexibility in this area. However, it's quite handy that upper and lower case can be used interchangeably in both commands and hex digits.

Although the insert gives very few details about using the monitor, with Quill you can examine the instruction pages stored as Mon Doc. These are quite comprehensive and should resolve any fine points on how to use the monitor. Most of the facilities needed are included in *Super Monitor*. You can create a Hex + ASCII

dump of 256 bytes using Sxxxxx, so for instance S123EF would display bytes from 123EF to 124EE hex.

Other facilities include Jump, Trace, Edit, Breakpoint Disassemble, and various load, save and catalogue options. Overall, a useful and fairly straightforward development tool which should find a place in the market.  
*Digital Precision*

## TYCOON

*Tycoon* combines two diverse ideas into an ingenious whole - not too surprising since it's devised by Victor Serebriakoff, International President of MENSA.

The game combines crosswords with business simulation. Up to six players have to make as much money as possible by solving crosswords and selling the solutions to the bank.

There are 49 crosswords graded by difficulty, and you can choose your level or let the computer select at random. Each appears on the top left of the screen with a few letters filled in. Your options include buying random or specific letters which are added to the grid, taking or repaying a loan, investing, or selling a word.

The version we saw is in SuperBasic, and has a couple of bugs. Newtech intends to produce a machine code version for the general market, and this should become a fascinating addition to the QL software library.  
*Newtech Publishing Ltd*

## SKETCHPAD

*Sketchpad* is a graphics development package which makes good use of the QL's advanced capabilities. Sensibly, Sigma Research offers the program for £14.90 and a version with joystick adaptor for £19.95. It's certainly easier to use a joystick than to rely on the cursor keys.

The program has six main features. The first is the ability to define and redefine the shape and size of the drawing window. The second allows you to alter the speed and movement axes of the drawing cursor.

Next, there are special functions allowing you to draw ellipses, circles, triangles, rectangles and arcs. You can then place text in a variety of sizes in the drawings, alter the colours and fill shapes, and save and reload pictures or print them out to Epson

compatible printers.

Several of the features of *Sketchpad* are unusually ingenious - for instance, the save function stores the objects drawn rather than whole screens, so hundreds of drawings can be stored on one cartridge.

*Sigma Research*

## TYPING TUTOR

The idea of a typing tutorial program, especially on a 128K computer, has always struck me as a sad waste of potential - in any case, the QL's keyboard isn't so good that it's worth trying to develop a high touch typing speed.

Having said that, the Computer One *Typing Tutor* is at least a fair example of its kind. Based on the standard ideas of home keys, and repetitive exercises building up to full familiarity with the keyboard, *Typing Tutor* also covers the QL's non-standard keys to some extent - the function and numerical keys for instance.

The manual explains the finer points of posture and good typing practice, and the exercises build up from simple to complex at your own speed. Each incorrect stroke produces a beep, and the machine then waits for you to hit the right key. By the time you've reached lesson 7, covering the use of capitals, you should be familiar with the keyboard and the essentials of typing skills - but the program won't calculate your typing speed, as some tutorials will. You have to work it out yourself, which seems a silly omission.  
*Computer One Ltd*

## SUPPLIERS

*Computer One*, Science Park, Milton Road, Cambridge.

*CP Software*, 10 Alexandra Road, Harrogate.

*Digital Precision*, 91 Manor Road, Higham Hill, London E17.

*Intersoft*, 7 Richmond Road, Exeter.

*Megacycal Software*, PO Box 6, Birkenhead, Meseyside.

*Newtech Publishing*, 8 Ferge Court, Reading Road, Yateley, Camberley, Surrey.

*Shadow Soft*, 70 Gooseacre, Cheddington, Beds.

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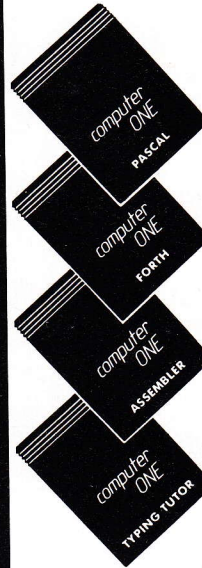
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# QL

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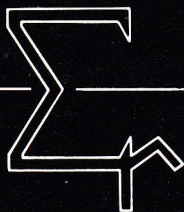
### PARALLEL PRINTER INTERFACE

Simply plugs into the 'Ser 1' port of the QL and any centronics compatible printer (eg:- EPSON, CANON, OKI, Kaga, Juki etc.)

works with PSION software and requires no special commands. Full instructions included.

### JOYSTICK ADAPTOR

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Each month, for a trial period, this column will contain details of readers' programs that we are able to offer on microdrive.

In return for a small administration charge (per program - including a royalty for the author), we will copy onto blank microdrives any or all of the featured programs.

Each program will be a direct copy of the published listing, or an extended version of that listing where the program in question was too long to print in full (programs for which an abridged version has been published are marked with an asterisk).

It must be stressed that we are not selling the software itself, nor providing any guarantee that it performs any particular function (though we do check every program that is to appear in *QL User*), we are merely offering a service to readers who wish to obtain *QL User* programs on drive rather than by typing them in straight from the page.

### HOW TO ORDER

Listed below are programs which have appeared as listings inside *QL User*. To the right of each program entry is a small box, which you should mark with a bold cross if you want to order that program.

Once you have put a cross next to all the programs you wish to have copied onto microdrive, simply complete the rest of the order form and send it along with your PO/cheque AND BLANK FORMATTED DRIVE to:

QL User, MICRODRIVE EXCHANGE, Priory Court,  
30-32 Farringdon Lane, EC1R 3AU.

If you wish us to supply the drive, please add an extra £2.50 for every drive required and mark the order form appropriately.

Please allow 28 days for delivery.

### ORDER FORM

Author	Language	Program Name	Price	Issue	Size	
Giles Todd	(B)	DIY Assembler	£5.00	Jun/Mar	120	<input type="checkbox"/>
<i>Converts Assembler source into m/c object code</i>						
Richard Cross	(MB)	Function Key Definer	£2.00	May	20	<input type="checkbox"/>
<i>Programmable function keys just like on the BBC</i>						
Rob Miles	(B)	3Dscapes	£1.00	May	20	<input type="checkbox"/>
<i>Isometric Perspective representations of 3D Surfaces</i>						
Shergold & Tose	(B)	* Golf	£2.00	May	30	<input type="checkbox"/>
<i>From fairway to green on 50 different courses of varying difficulty</i>						
Williams & Holliday	(AO)	Paladin	£5.00	Apr	80	<input type="checkbox"/>
<i>The basis of our games programming series - a space invaders type game written entirely machine code</i>						
Richard Cross	(MB)	Sprite Animation	£2.00	Apr	32	<input type="checkbox"/>
<i>A subtle blend of machine code and SuperBasic that produces a versatile sprite designer and high speed animator</i>						
Steve Deary	(B)	Pacman	£1.00	Mar	20	<input type="checkbox"/>
<i>A reasonably fast rendition of the famous arcade favourite</i>						
Adam Denning	(AO)	File Probe	£1.00	Mar	2	<input type="checkbox"/>
<i>Machine code routine utility to dump the contents of a file to any device in hex. Reveals any hidden control characters for all to see</i>						
QL User	(B)	Tape Utility	£3.00	Feb	15	<input type="checkbox"/>
<i>File utilities which permit selective back-ups and deletions - in excess of a hundred files may be manipulated</i>						
Andy Carmicheal	(B)	Hi-tech Sort	£1.00	Feb	10	<input type="checkbox"/>
<i>Highly efficient recursive sort based on C Hoare's famous Quicksort method</i>						
PJ Smith	(B)	* DIY Adventure	£1.00	Feb	70	<input type="checkbox"/>
<i>A skeleton framework where you simply have to slot in the details to create your bespoke adventure</i>						
Mike Newport	(B)	Pseudo Editor	£1.00	Feb	20	<input type="checkbox"/>
<i>An ingenious half-way house between a full screen editor and the QL's somewhat primitive line editor</i>						
Adam Denning	(AO)	Multitasking	£2.00	Dec/Jan	15	<input type="checkbox"/>
<i>Two digital clock programs and one alarm. All will happily multitask on the QL</i>						

B = SuperBasic, AO = Assembler + Object Code (ready to run), MB = Machine Code + Basic loader

Name

Address

No of programs ordered ..... Total cost £.....

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No of drives sent .....

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Plus postage & packing £ 0.75

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Add VAT @ 15% £.....

TOTAL TO BE SENT £.....

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# INSTA

Each month this directory is updated with new products and information.

If you or your company are currently manufacturing hardware or supplying QL

software and would like to be included within this directory, just send details to 'QL User Reference Chart', Dept SE, QL User, Priory Court, Farringdon Lane, EC1R 3AU.

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### Monitors

Citadel Products Ltd  
01 951 1848

MBS Data Efficiency  
0442 60155

Kaga  
Microvitec PLC  
0274 390011

Microworld Computer & Video Centre  
0293 545630/0273 671863  
Microvitec, Philips, Sinclair Vision

Opus Supplies Ltd  
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Printerland  
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Microvitec, Kaga

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Star

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Canon

Microworld  
0293 545630/0273 671863  
Kaga, Epson, Smith Corona, Shinwa, MicroPeripheral, Quen-data, Juki

Printerland  
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Epson, Brother, Kaga, Canon, Juki

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Epson, Kaga, Juki, Brother

Twickenham Computer Centre  
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Kaga, Ensign, Canon

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*QL Case*

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**Sunshine**  
01 437 4343

### Book Titles

**Getting To Know Your Sinclair QL**  
Morris  
(Duckworth £7.95)

**Exploring Artificial Intelligence On Your Sinclair QL**  
Hartnell  
(Interface £6.95)

**The C Programming Language**  
Kernighan & Ritchie  
(Prentice Hall £22.95)

**Learning to Program in C**  
Plum  
(Prentice Hall £15.95)

**Logic, Algebra & Databases**  
Gray

(Ellis Horwood £9.95 p/back, £22.95 h/back)

**68000 Assembly Language Programming**  
Kane, Hawkins, Levanthal  
(Osborne/McGraw Hill £19.50)

**QL Gamesmaster**  
Ewbank, James & Gee  
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**A QL Compendium**  
Gandoff & Kinge  
(Addison-Wesley £7.95)

**QL Handbook**  
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(Interface £7.95)

**Professional & Business Uses of the QL**  
Lewis  
(Collins £7.95)

**QL Abacus**  
Spottiswoode  
(Century £8.95)

**BASIC Programming on the QL**  
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**Quick QL Machine Language**  
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**Digital Precision**  
01 527 5493  
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0954 81991  
*QL Assembler, Q Jump, QL Toolkit*

**Harcourt**  
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*QL Touch 'n' go*

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0272 428781  
*Assembler, BCPL, Lisp*

**MicroAPL**  
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*Stockmarket manager*

**Positron Computing**  
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*Hi-res Screen Dump*

**Printerland**  
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**Psion**  
01 723 9408/0553  
*Quill, Abacus, Easel, Archive*

**Quest**  
04215 66488  
*Business Accounts*

**Sinclair Research**  
0276 686100  
*QL Entrepreneur, QL Project Planner, QL Decision Maker*

**Strong Computer Systems**  
0267 231246

**Super Plant Software**  
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*Shrub Bank & Planner, House Plant Bank & Planner*

**TDI Software Ltd**  
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